AVIATION WEEK

FEB. 25, 1952

THIS ISSUE $1.00

A McGRAW-HILL PUBLICATION

The Nineteenth Annual INVENTORY OF AIR POWER

SUNDSTRAND "PACKAGE-TYPE" CONSTANT SPEED DRIVE

as applied to the Consolidated B-36

OTHER APPLICATIONS

- Merlin P5M
- Bell B-50D
- Guided Missiles
- North American
- Northrop

First of three distinct types of Constant Speed Drives developed by Sundstrand, this "Package-type" has proved itself on the B-36 and the P5M-1. Maintenance records of the B-36 show upwards of 6500 trouble free constant speed drive hours. It is now being adapted or under consideration for accessory drives on other aircraft which can accommodate an installation coupled with a shaft from the engine. Its advantages include ready availability, adaptability to existing airframes and efficient extraction of power from the engine by mechanical shaft. Special adaptations can be developed for you through Sundstrand's *reliable* research, *expert* engineering, and *precision* production.

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SUNDSTRAND AIRCRAFT HYDRAULICS

SUNDSTRAND MACHINE TOOL CO.
HYDRAULIC DIVISION ROCKFORD, ILL.

AIRCRAFT AND INDUSTRIAL HYDRAULIC TRANSMISSIONS • PUMPS • MOTORS AND VALVES • OIL BURNER PUMPS • AIR SANDERS
LATHES • MILLING, BROACHING AND SPECIAL MACHINES • BROACHING TOOLS • MAGNETIC CHUCKS

B.F.Goodrich

Trans-Texas is eighth airline to switch to new dimpled tire

A NEW KIND OF TIRE designed to give longer service life has been introduced by B.F.Goodrich. Instead of conventional ribbed treads, this tire has a new kind of tread design with round, dimple-like indentations in the rubber. The dimple indentations provide better distribution of the tire load and reduce exposure to tread cutting.

Trans-Texas Airways put the tire through a series of extensive tests. They found the new dimpled tire outwore all other tires they have used. It gave 800 landings before retreading. In addition the unconventional tread design made retreading simpler and there were fewer carcass rejections. As a result of these tests Trans-Texas is now switching to the new dimpled tire as standard equipment.

Trans-Texas is the eighth airline to adopt the new BFG dimpled tire. The other airlines who have tested and switched to the dimpled tire are Braniff, Capital, Continental, Empire, Mid-Continent, National and West Coast.

B.F.Goodrich is now producing the dimpled tire in seven sizes. The new, longer wearing dimpled tire is another example of BFG's leadership in rubber research and engineering. Other B.F. Goodrich products for aviation include wheels and brakes, heated rubber De-Icers, Avrim Plastilock adhesives, Pressure Sealing Zippers, inflatable seals, fuel cells, Rivnuts, accessories. *The B.F.Goodrich Company, Aeronautical Division, Akron, Ohio.*

B.F.Goodrich
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Aviation Week

ABP Member ABC

Volume 56 — February 25, 1952 — Number 8

Inventory of Air Power

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Here's How This

JOY AXIVANE® Aircraft Fan

Solved a Problem of Unmatched Complexity

WHEN the Air Force and Consolidated Vultee, manufacturer of the B 36, decided it was necessary to have a pressurization booster on this king-size bomber, they really threw the design book away The requirements for the blower would cause any prospective fan supplier to have misgivings Specifications called for three separate fan-duties

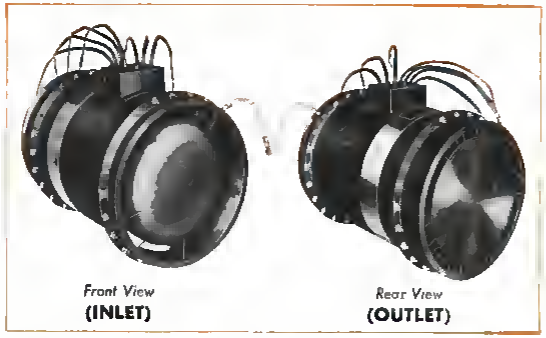
a *1180 CFM at 32" W G, with an air density of 0 044 lbs./cu ft*

b *700 CFM at 40" W G, with an air density of 0 10 lbs./cu ft*

c *680 CFM at 26" W G, with an air density of 0 070 lbs./cu. ft.*

Space and weight limitations were stringent. The fan had to operate without excessive horsepower requirements due to a critical load on the generators In addition, the fan motor had to be protected from hot air in the duct system

Just about when the job seemed impossible, it was turned over to Joy engineers . . . and not only was the problem solved to the complete satisfaction of both the Air Force and the manufacturer, but the prototype fan was in their hands only six months after Joy received the order



Front View **(INLET)** *Rear View* **(OUTLET)**

The fan exactly meets the three duties specified It is 10" in diameter and 17" in length Because of its combination of magnesium and aluminum construction, the fan weighs only 54 lbs It is a two-stage unit, driven by a two-speed, 400-cycle motor The efficiency of vaneaxial-fan design permits using a motor rated at only 12.6 H P continuous duty The stationary vanes which support the motor are hollow, so that cooling air can be continuously directed over the motor Each stage of the fan has a set of straightener vanes. Casing and hollow vanes are a single casting for shock-resistant strength.

● We freely admit that this is one of the toughest fan design-problems Joy engineers have ever tackled On the other hand we are just as sure that, in the future, even harder problems will be taken on and solved Even if your aircraft fan problem is not a difficult one, it is a good bet that the incomparable vaneaxial-fan design know-how which produced *this* AXIVANE fan will give you the most for *your* money If you need an aircraft fan for any purpose, call on JOY—the world's largest manufacturer of vaneaxial fans

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Consult a Joy Engineer

WAC A3055

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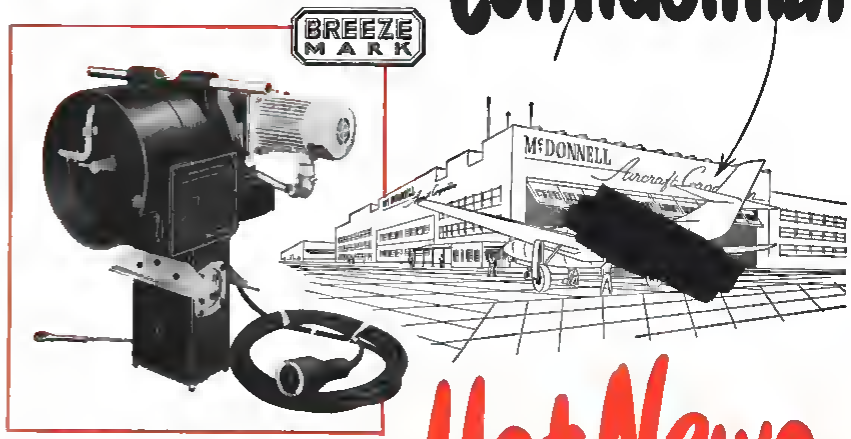

but the WINCH is Hot News

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SOLUTION:

A portable battery-operated Breeze Engine Winch, quickly installed in the aircraft itself, permitting removal or installation of the engine at will, with drum for 300 inches of cable. *Weight:* 103 lbs., *Load:* 2,600 lbs., *Motor:* 27 volt DC, reversible.

Another Breeze Mark product, typical of the advanced engineering developments the aircraft industry has come to expect from Breeze Corporation.

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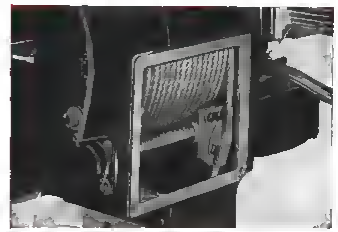

Close-up view of winch with cover removed, showing detail of cable crank and shaft mechanism.

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MILITARY AIRCRAFT RECONDITIONING CONTRACTORS

"Battle Tested" Scott A-15

Emergency Walk-Around Breathing Equipment is AVAILABLE

This portable, Automatic Diluter Demand Oxygen Walk-Around Equipment, standard on U S A F bombers, cargo and personnel carriers is again in production and available to military Aircraft Manufacturers.

Technical Description: U S A F Type A-1 Cylinder and Regulator Assembly consists of U S A F Type A-15 Low Pressure Diluter Demand Oxygen Regulator. (Designed and produced by Scott. Automatically mixes air and oxygen, supplying correct air-oxygen ratio for all altitudes up to 34,000 feet.) AND U S A F Type A-6 Low Pressure Portable Oxygen Cylinder

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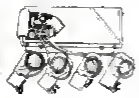
PORTABLE (DEMAND) OXYGEN EQUIPMENT
6000 81 C for crew protection in smoke or fumes. Supplies 100% oxygen

AVIOX: The Scott constant flow oxygen equipment built into a hand some leather luggage case, supplies supplementary oxygen for one to four persons.



FIXED SYSTEM OXYGEN EQUIPMENT No 8500 For all aircraft "from a Cub to a Connie", providing a complete oxygen system including supplementary oxygen for crew and passengers demand oxygen for smoke and fume protection for crew. Its regulator supplies required oxygen up to 30 000 ft for up to fifty outlets

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No 5500 Supplies supplementary oxygen for passengers or crew

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Supplies 100% oxygen on demand for emergency smoke or fume protection. Also constant flow to re breather type masks for therapeutic or high altitude use.

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The Scott disposable constant flow partial re breathing type mask. Low cost, light weight sterile, durable

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No 9540 is inserted in tubing between source and mask shows when oxygen is flowing

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Snap-in sleeve on Monowatt Wall Mounting Receptacles and Straight Plugs allows easy access to insert for soldering and inspection. Sleeve snaps in and cannot work loose yet can be released quickly with a small screwdriver for removal of insert. With this new type sleeve and Monowatt's one-piece solid housing it is possible to use a solid shell connector in applications which would otherwise call for a split shell. Extra weight and possible loosening of threaded parts under vibration is eliminated.

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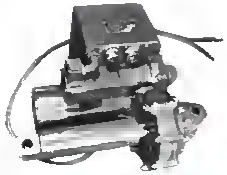


DOUBLE MOTOR POWER UNITS

These radical motor arrangements use a small, continuous duty motor operating through a gear reduction to trim aircraft in automatic flight and a large intermittent duty motor for manual operation in maneuvering

One unit is a complete motor actuator The small, continuous duty motor of 1/10th h p provides a rate of travel of 6/100" per sec to the screw jack, the large, intermittent duty motor of 3 3 h.p operates screw jack at a rate of 7/10 per sec Normal operating load is 11,000 lbs 28 volt operation Equipment includes overload and travel limit switches, radio noise filters, position indicator and non-jamming stops.

The other unit illustrated employs a small motor of 1/15 h p with integral gear reduction and a large 3 3 h.p motor with direct drive of 12 000 rpm.

EEMCO

TECHNICAL BULLETIN

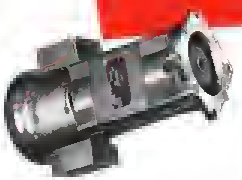
Special Actuators and Motors for Today's Special Aircraft

Fool-proof power units to actuate controls in conjunction with the automatic pilot are primary factors in the advancement of automatic flight. EEMCO helps the industry build for the future by designing and manufacturing motor actuators that keep pace with the far-reaching demands of planes on the drawing board.

The EEMCO designs briefly described in this bulletin are a few of the more advanced units designed and produced during the last year in cooperation with leading aircraft manufacturers.

ELECTRICAL ENGINEERING & MFG. CORP.

4612 West Jefferson Boulevard, Los Angeles 16, California



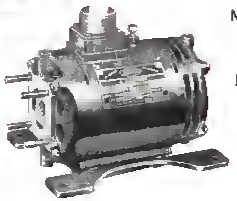
HYDRAULIC PUMP MOTORS

Save space, weight—increase efficiency Light compact pump drive assemblies are achieved with special EEMCO motors designed to couple directly to new type high speed hydraulic pumps, thus eliminating conventional gear box.

Motor #1 was designed for an allowable pump speed of 7200 rpm and mounts directly on the pump with an internal spline drive within the armature shaft providing the coupling

Motor #2 provides these same advantages by coupling directly to a hydraulic pump which operates at 11,200 rpm.

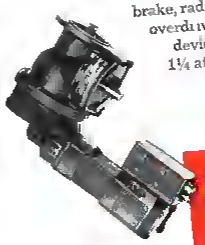
Can be supplied with integral gear box and standard A N mounting pad for operating lower speed pumps.



ROTARY ACTUATOR for Tough Duty Cycle

Designed for stabilizer actuation in a long range bomber. Required duty cycle is one second full load one second off and one second full load in opposite direction continuous.

Conforms to requirements of ANM-40. Equipment includes magnetic clutch and brake, radio noise filter, manual overdrive and torque limiting device Rated motor h p. is 1¼ at 9000 rpm continuous.



EMERGENCY STAND-BY MOTOR for use on Supersonic Research Aircraft

Designed to operate under high ambient temperatures of 70°C at 50,000 ft. altitudes Duty cycle is 1 minute at 1 H.P. 30 seconds at 2½ H P. High temperature materials used throughout Motor weight, including gear box—22½ lbs.

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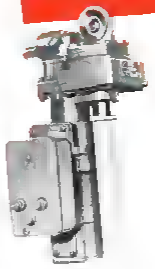
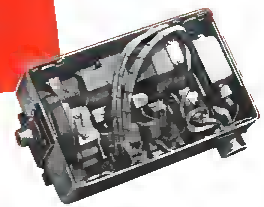
FEATHERWEIGHT LINEAR ACTUATOR for Jet Wing Flaps

Two actuators are interconnected by flex shafting. Single brake operated by either motor provides quick and accurate positioning. Either motor can safely operate entire system in emergency under any condition of ambient temperature and maximum operating load with supply voltage as low as 20 volts. Weighs only 8 lbs., 3 oz





COMPACT ROTARY ACTUATOR PACKAGE

Entirely self-contained rotary actuator package combines compactness, high performance, and light weight. Totally enclosed in a metal box, it incorporates motor, magnetic clutch and spring loaded brake. The unit provides continuous elevator correction on one of the latest jet fighters through the automatic pilot.

CHRYSLER SIREN: Remote Controlled, with the Loudest Sound for Civilian and Plant Defense!

An unportant contribution to Civilian Defense, the NEW Chrysler Air Raid Siren produces the loudest warning sound ever achieved for modern production.

Recent development of a new 180 horsepower Chrysler Industrial V-8 Engine enabled Chrysler engineers to produce power for a 3 stage compressor. Increased pressure from this compressor drives air through 6 giant horns at 400 miles per hour producing a sound of approximately 173 decibels! This warning can be clearly recognized over a diameter of 8 miles under normal conditions.

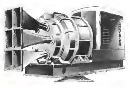
It is designed to fill the pressing need for *a positive* signalling device for City and Industrial air raid warning. Because it has *self contained power* it is independent of vulnerable central power systems.

One, or any number Sirens may be remote controlled from a central control station if desired. They may be operated without personnel being on or near them. When in operation, the Siren makes one complete revolution every minute.

These Sirens are available only for Defense Warning Systems. They may be purchased by Cities and Towns, Defense Plants, Airports, Military Installations and other vital areas needing air raid protection.

For complete information, specifications and availability write ***Marine and Industrial Engine Division, Chrysler Corporation, 12204 East Jefferson Ave., Detroit 31, Michigan.***

CHRYSLER



Piasecki

8 YEARS

FAFNIR

In developing and building bigger, more dependable helicopters for military transport and rescue service, Piasecki is helping to assure the future success of the helicopter industry. Right from the start, over 8 years ago, Piasecki turned to Fafnir for help in solving bearing problems. Good bearings alone were not enough. Piasecki valued the unique attribute of Fafnir — its attitude and aptitude — a way of looking at ball bearings from the designer's side, an aptitude gained from more than twenty years' specialization in ball bearings for aircraft. The Fafnir Bearing Company, New Britain, Connecticut.

Fafnir Ball Bearings designed for rotor cyclic pitch control — one of the Fafnir Ball Bearing types regularly specified by Piasecki. Plya-Seals keep grease in, contaminants out

insuring long service life and uniformly low torque

AVIATION WEEK VOL. 56, NO. 8 FEBRUARY 25, 1952

Analysis of Air Power

'Dual Economy' Clamps Lid on Production

DEFENSE WAS PUSHED TOO HARD Aircraft production showed signs of rising this year too fast to fit into the already decided hard and fast mobilization and political plans.

That, and also the fact that the original schedules were unrealistic, are the underlying reasons military aircraft production has been "stretched out."

High production is still the seed from which all air power grows. The civilian mobilizers know that as well as the military. But "don't push defense too hard" is still firm government policy now, as it was when we first analyzed the beginnings of that policy in "Production for Air Power" last September 24. It was pointed out then that the two philosophies were bound to clash.

The military and the aircraft industry have laid the groundwork for stepped-up production this year.

The increase would have wrecked the delicate "dual economy"—a tremendous military output piled on top of expanded civilian production—that the mobilizers have been haltingly erecting.

The stretch-out will have deep ramifications on our economy, our military air services and our industry for years ahead. Careful study of public and private statements made by top Washington officials indicate where the plans went awry—and the inevitable effects.

●

I. The Dual Economy

EXPANDING THE BASE for production remains the keystone around which the dual economy is being fashioned. That expansion must start at the bottom, by first increasing the productive capacity of the basic industries—steel, aluminum, copper, power, etc.

With the enlarged basic industries as the trunk of your economic tree, you can let both the military and civilian branches grow free. But until the trunk is bigger, you must keep the branches pruned.

We haven't reached that point in expanding the basic industries. The curve of military production was starting to break sharply away from that of civilian output. If it kept rising, it would have drawn away some of the materials needed to feed the basic industries.

It also would have gobbled up materials needed for civilian production.

Defense Mobilizer Charles E. Wilson has said that military demands on scarce materials this year would have been so great as to cut civilian output to levels tolerable only in an all-out war.

SOMEBODY WAS BOUND TO BE HURT as defense production grew and ate into the supply of materials. In September AVIATION WEEK pointed out that the planners were gambling on keeping their two economies in balance. They lost.

What has happened in Detroit was the proof they had lost. First and sharpest hit of the big industries by the burgeoning defense production was automotive manufacturing.

In this nation's complicated industrial complex, Detroit isn't just "somebody."

The automotive industry directly and indirectly gives employment to one-seventh of the entire U. S. job force. Already there are upwards of 200,000 out of work in the Detroit area because materials shortages forced cutbacks in auto output.

Some say the stretch-out—which lets Detroit get more materials—means government mobilizers yielded to the politically powerful United Auto Workers. But it is still true that the automotive industry by some standards is the nation's largest. If the mobilizers crippled it, they might cripple the civilian economy.

They must strive for the dual economy. For war may not come for years, or ever. If defense spending some day can taper off, we will need the enlarged civilian capacity to take up the slack.

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II. The Military

THE MILITARY MISTOOK a conditional "yes" for an unconditional "yes" that later was changed to "yes, but." That's why production this year was starting to rise so fast.

When the Korean war began, both the political and military leaders got scared. Our Air Force was a bare bones 48 groups. Naval Aviation was obsolescent. The Administration and the military leaders had to recognize that Korea might be followed by invasion of Indo-China, Iran, Jugoslavia, all-out war.

The military thought the sky would be the limit on appropriations, that they had to get ready for all-out war as fast as possible. No one told them differently then, although the political leaders must have had some mental reservations.

"Letters of intent" cascaded on industry. Contractors started ordering materials, erecting new plants, raising production sights. Plans were rushed to expand the capacity to produce.

(News of the Week on page 273)

All these steps were like due bills on the Air Force and Navy. The bills were coming due this year. They were to be paid with money that tentatively was promised the services after Korea. But the Administration has decided the international tension has eased. So military budgets have been cut and the military will not have the money they expected to get to pay their bills.

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THERE HAS BEEN NO ALL-OUT WAR in the period when it was expected. Perhaps the prompt action right after Korea is responsible. Our defenses are much stronger. USAF has nearly doubled, so, too, has Naval Aviation. The Strategic Air Command is still buying time for us to prepare. Much of the expanded capacity to produce is ready.

So the Administration now can say that in 1950 its "yes" was conditional. When the Korean war broke out officials planned to be ready for all-out war within a year or so. It is 18 months later and the international situation is no worse.

●

THE MILITARY ASKED FOR $85 BILLION for the upcoming fiscal year 1953. The President cut this down to about $52 billion.

If the Administration granted the larger sum, the output of planes, guns and tanks the money would pay for would be too great a blow to the civilian economy.

This rationalization dovetails neatly with the political advantage of striving for economy in an election year.

The stretch-out may not have been dictated wholly by political considerations. However, the economically necessary step turned out to be the politically popular step.

In this sense, the Administration couldn't have been luckier.

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BUT THE DANGER IS IMMEDIATE, in the military's view. The stretch-out lowers production now as well as a year from now. Our air forces are weaker today than they will be a year from today—provided there is no all-out war in the interim. Accordingly present deliveries are vitally important.

It is not from choice that USAF has 150 F-86s stacked against 700-800 MiGs in Korea. USAF, as well as Navy, needs planes now if air power is to deter further aggression.

Insofar as the stretch-out interferes with fulfilling that need, it may well be the most desperate risk ever undertaken by an American government.

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III. The Industry

THE STRETCH-OUT IS GOOD BUSINESS for the aircraft industry, despite a few moans.

For years the aircraft manufacturers have asked the government to guarantee stability in the industry—a consistent and planned level of production.

That is precisely what the stretch-out does.

Under the original plans, the industry was asked to hit peak about mid-1954, slide off and level out at a lower rate. Now it will hit a lower peak later and hold it longer. Industry leaders have known all along the original schedules were unrealistic. The stretch-out confirms their view.

So sales in the next two years will be lower than once planned. But after that they will be steadier.

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TWO GRAVE WEAKNESSES in the stretch-out can, however, cause trouble for aircraft manufacturers and their satellites.

When you slow down production of end items such as planes and engines, you have to slow down all along the line—clear back to the supplier of the smallest part.

The pipelines were starting to fill up to meet the needs of the old, higher schedules. It had taken industry 18 months to fill them.

Supplies and materials now will trickle, instead of flow. Even if the expanded base is ready this year or next, it will take longer to build all-out production on it than it would now. The pipelines would have to be filled again.

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PRIME MANUFACTURERS WILL PULL BACK work into their home plants under the stretched-out schedules. This is going to hit subcontractors hard.

One of the motivating reasons for the stretch-out was to prevent many small businesses from going to the wall.

Yet, the stretch-out is likely to have exactly that effect on hundreds of subcontractors—many of whom are small businesses.

Subcontracting is not always the cheapest nor the fastest way to get production. It was encouraged by the mobilizers because it broadens the base for expanding production.

So the mobilizers face the unnerving possibility that their stretch-out may destroy their very own policy of expanding the base.

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THE DUAL ECONOMY CONCEPT was German in origin. Under the label "armament in depth," it was proposed to Hitler by the general staff in the middle Thirties. It was rejected because Hitler wanted munitions fast for a fast war.

One way to get munitions fast is to freeze designs which Hitler did. There's an undercurrent of that thinking in Washington now. But it is incompatible with the dual economy because in the end it also means giving priority to military production. There is no point in freezing designs unless you're going to take the brakes off production.

We said in September that the dual economy has never successfully been built by any nation. It still has not. The stretch-out is a daring gamble to make it work a little longer.—William Kroger

(News of the Week on page 273)

INTERCONTINENTAL BOMBER, Convair B-36, is still backbone of strategic air force. But augmenting it will be

MEDIUM BOMBER, Boeing B-47, which will operate from foreign bases if available to give Strategic Air Command varied attack

Air Policy Still Rests on Strategic Bomber

The tools of our military air power are changing, but without a basic change in policy for their employment.

There is more emphasis in procurement on medium bombers, on all-weather interceptors, on long-range escort fighters, on ground support planes.

The U. S. has a resurgent Navy—and a Naval air arm steadily growing in strength.

The tools and the new effort are bent toward a familiar goal.

Our military air policy is still rooted in the principle that a strong strategic bombing force can deter aggression, and in the extension of that principle that by strategic bombing we can make it impossible for an enemy to win a war it may start.

The intercontinental bomber has not been eclipsed. But since that weapon was first conceived there have been changes in the world and in our own military technology. There are now other potential ways of conducting strategic air war.

The pressure of three events have had a profound influence on our military air plans and planes:

- **Obtaining of foreign bases** both within and without the structure of the North Atlantic Treaty Organization.
- **The Korean war** and our first experience with a jet fighter plane produced by the potential enemy, Russia.
- **The development** of smaller atomic weapons.

Successful policy is not a static thing to be filed away in a dusty drawer and

Military Aircraft Appropriations & Expenditures, 1899-1951

Fiscal Year	ARMY AIR CORPS & U. S. AIR FORCE				NAVAL AVIATION				TOTALS	
	Total Approp.[1]	Total Expend.[1]	Aire. Approp.[1]	Aire. Expend.[1]	Total Approp	Total Expend.[1]	Aire. Approp.[1]	Aire. Expend	Aire. Oblig. & Approp.[1]	Aire Expend.[1]
1899	$ 03								$ 03	
1900	03								03	
1901	03								03	
1910	1				$ 09				13	
1911	1				01				11	
1912	6				01				21	
1913	6				01				21	
1916	6				1 0				1 6	
1917	16 2				6 5				22 0	
1918	735 0				61 6				796 6	
1919	952 3				220 4				1 173 2	
1920	28 1				23 5				63 6	
1921	66 3	$99 9			20 0				66 0	
1922	20 6	28 1			16 1	$13 9			44 7	$37 9
1923	13 1	16 1			14 5	17 0			27 6	33 0
1924	13 8	11 0			14 2	15 0			27 3	25 0
1925	16 6	11 5			15 5	13 4			20 2	25 1
1926	15 0	14 0			15 2	16 0			94 1	30 8
1927	15 6	15 8			60 4	15 8			87 7	32 3
1928	61 1	15 4			60 3	22 4			61 4	41 8
1929	66 6	23 3			32 5	25 8			91 3	61 8
1930	34 6	28 1			61 6	28 5			66 4	56 6
1931	36 6	38 5			32 1	30 0			71 6	68 7
1932	31 0	33 6			61 2	31 6			60 1	64 6
1933	60 7	31 6			25 4	31 4			61 1	64 3
1934	31 0	17 4			29 7	16 5			60 5	33 6
1935	27 0	20 5			62 1	21 6			60 0	46 1
1936	48 6	22 6			60 7	22 6			66 5	55 0
1937	56 6	41 1			35 6	35 6			92 2	67 5
1938	58 6	50 9			61 6	60 6			110 4	111 7
1939	71 1	53 2			60 1	62 6			115 6	130 7
1940	196 6	105 2			111 6	60 5			300 1	165 7
1941	2,173 6	926 4			432 6	195 5			2,624 6	1121 1
1942	23,648 0	2,900 0			6 139 4	1 062 6			29,220 6	3,962 4
1943	11,217 4	6,361 6			6 258 6	5 945 6			16 978 4	15 236 2
1944	23,580 0	15,087 5			4 683 7	4,469 1			28 239 [2]	17 557 4
1945	1,810 [2]	11,257 4			4,900 6	6,135 5			6 311 6	16 487 4
1946	5 420 6	6,170 8	$398 2	$240 0	922 4	N A	$64 3	N.A.	454 6	240.0*
1947	3,144 4	2,283 0	477 6	870 [2]	805 [2]	[2]53 4	20[2]9	$265 6	[2]56 4	530.5
1948	3,334 4	3,011 5	1,941 6	650 6	740 0	769 1	328 2	105 6	1,375 6	739 9
1949	3,206 6	3,013 3	[2]31 6	801.6	1,338.0	876 0	[2]38.7	312 8	1,409 6	814 4
1950	4,720 6	5,402.2	1 [2]80 6	1 266 1	1,[2]58 4	935 6	963 0	440 04	2,618 6	1 709 1
1951	16,[2]00	6,581	8 114	1,[2]90	4,[2]87	1 031	3,451	535	11,[2]60	6 [2]2"
1952	22,[2]25	15,[2]96	11,585	4,000	5 [2]33	1,[2]00	4,338	1,[2]00	18,216	5 [2]00
1953*	20 436	18 681	12 [2]90	9 [2]00	4 [2]98	5 41[2]	6,[2]50	2,[2]50	16 [2]89	11 500

[1] In millions of dollars.
[2] Estimated.
[3] Air Force only
* $142 million withheld by the Secretary of Defense.
SOURCES: Rudolf Modley, USAF, U. S. Navy

examined only on rare occasions. It is dynamic, constantly reviewed and revised as conditions demanding the policy change.

And those three events, each in its own way, have caused a review of our policy of maintaining a strong strategic air striking force.

A Policy for the Present

The concept of strategic air war, of course, goes back to World War I. It was given substance in World War II, with Pantelleria, Schweinfurt, Ploesti and Hiroshima as symbols. An island cut off and forced to surrender, production of a vital part for industry slowed, the lifeblood of a modern military machine interrupted, and finally an entire military and industrial area destroyed with one bomb.

This last was perhaps the deciding factor in the adoption of the policy of reliance upon a strategic bombing force.

We alone of the world's nations at the close of World War II had the atomic bomb. If we also maintained the ability to deliver it anywhere in the world possibly we could deter aggression.

The low military budgets of postwar years accentuated the trend toward reliance upon a strategic air force. Unless and until a potential enemy also developed an atomic bomb and the means to deliver it, the nation was fairly secure in putting most of its money into intercontinental bombers. In fact, assuming that the decision to concentrate on a strategic air force was sound, there really was no other place to put the money. The U. S. was the only friendly territory from which strategic bombers could operate.

Formation of the North Atlantic Treaty Organization with collateral agreements with other key nations, was the first event to ease the pressure on the intercontinental bomber build up. NATO gives the U. S. access to air bases abroad from which medium bombers could range well within the Iron Curtain.

▶**The Alarm Sounds**—The outbreak of war in Korea was a fire alarm, signaling the need for strengthened defenses. In ensuing months, its combat lessons were to be of inestimable value to both Air Force and Naval aviation. But its immediate effect was to pour into the military services the money they had been requesting and not getting for two years.

This money underwrote the modifications of the grand strategic plan. It made possible the emphasis on medium bombers. It made possible plans and plants for tactical air support the need for which has been pounded home by both NATO and Korea.

While the U. S. gets foreign bases through NATO, it takes on obligations. We have to assist the other member nations to strengthen their forces against aggression. There is no hope of matching Russia division for division on the ground. The difference has to be made up in tactical air. And the U. S. is expected to furnish the tactical air power.

Tactical air saved Korea for the United Nations in the early days of the war, those who were there agree. It has remained the great equalizer of UN and Communist forces. In addition—a generally overlooked fact—more tactical air is needed because the defense build-up has brought a larger army.

▶**Navy's Role**—And finally, Korea called for a review of the Navy's role in the master plan for waging an war. The conflict in that far-off primitive country proved we need an air Navy, at least for present policy, for transport (Navy carriers hauled Air Force fighters and fuel to Japan), for ground support, for interdiction and for bomber escort.

Development of small atomic weapons undoubtedly had been underway long before the formation of NATO and the start of the Korean conflict. And planners probably had reckoned with them. However, public acknowledgement of work in that field came only after the Korean war had begun, and with it some public talk that gives an inkling of the influence of the new weapons on the strategic planning.

Basically, smaller atomic weapons are presumed to make any plane that can carry a sizeable bomb an "atomic bomber." The propaganda value for the Navy inherent in that fact is enormous. If Navy attack bombers can carry an atomic bomb, Navy officers once again circumspectly can talk about a Naval air strategic striking force.

▶**New Concept**—And if Navy attack bombers can carry atomic weapons so, too, can Air Force fighter bombers. This has brought forth a fairly new theory, "retardation" on the battlefield of enemy troops—and a new argument for the opponents of strategic bombing. If you can destroy masses of men and materiel in one area with atomic weapons and leave a morass of radiation through which no reinforcements can advance, the theory runs, you can end the war on the spot and avoid the bombing of civilian centers.

To top Air Force and Navy leaders, retardation of troops means just that and does not eliminate strategic air war. To them, destroying materiel at the front lines is trying to win a war the hard way. Shut it off at the source, they say.

So, through three profound upheavals in our military and political course, the path of our present policy has been directed toward a continued strengthening of our strategic air striking power.

But those three upheavals have left marks on the two services charged with wielding the power, the Air Force and Naval aviation.

U. S. Air Force

In the days following the war when the Air Force, the aircraft industry and special groups vainly were urging an air build-up, their repeated warning was that in the next war there would be no time to prepare, we would have to fight with what we had the day war came.

Korea ruefully proved the point.

The United States Air Force, when established in September of 1947, was given three basic missions: defense of the country from air attack, waging of strategic air war, and furnishing tactical air support. (A fourth responsibility, air transport, was added later.)

Because of national policy, the second mission, the waging of strategic air war, got first priority. The bulk of AF procurement funds went into the intercontinental B-36 for the Strategic Air Command. The bulk of AF training and operation funds and effort went into SAC.

▶**Little Air Defense**—By early 1950 defense officials were able to warn potential aggressors that a bomb dropped on this country would bring many-fold retaliation within 48 hours. Retaliation, in fact, was our only defense. Emphasis on SAC had not permitted the building of a modern air defense force. An early warning radar net was being woven around the approaches to the North American continent. But it is questionable how much good the warning would have done.

The U. S. Air Force was preparing to fight a strategic air war. The only trouble was that the Korean conflict—where the Air Force had to fight for the first time since World War II—wasn't the kind of war in which air power could be used most effectively. Political considerations limited its play.

SAC proved that the money and effort put into it had not been wasted. Within eight days after the outbreak of war in Korea, B-29s of SAC had moved from March Field, Calif., and were dropping bombs in North Korea. Within a matter of weeks they had destroyed the few strategic targets in North Korea.

▶**Targets Immune**—But the industrial source of the Communists' military

USAF Planes on Hand

As of Jan. 1 in the year below	Type				Totals
	Combat	Transport	Trainer	Communications	
1941	1,700	124	9,009	8	2,941
1942	4,477	254	7,340	226	15,297
1943	11,607	1,651	17,909	9,796	39,304
1944	27,448	5,466	28,051	4,367	64,332
1945	41,361	10,926	17,360	3,240	78,726
1946	20,021	5,509	5,611	3,694	44,732
1947	17,165	4,638	5,597	2,614	30,038
1948	15,116	2,838	6,714	1,446	25,114
1949	9,051	6,012	6,177	1,148	20,388
1950	8,004	2,536	6,611	500	17,222
1951	6,139	5,564	5,601	338	17,237

SOURCE: USAF

USAF Aircraft Procurement

Model	Fiscal Year[1]				Totals
	1686	1947	1948	1949	
B-36				78	78
B-45			69	43	169
B-47				16	16
B-50	55	79	82	132	348
F-80				552	637
F-86	350				350
F-84	141	181	184	409	885
F-86		63	196	333	554
F-89				48	48
YF-93			2		2
F-94				110	110
C-82			20		20
C-97			27	29	56
C-118	1				1
C-119			36	99	135
C-121			10		10
YC-122			2		2
C-124			1	28	29
YC-126			23		23
T-28				286	286
T-29				36	36
T-33			28	128	156
H-5	24	11	39	16	100
H-12	10	34			44
H-13	18				18
F-10				6	6
SA-16			30	52	80
L-13	140	80			220
Grand Total					4 244

Note: Excludes experimental types. Navy types purchased for evaluation purposes, aircraft purchased for Army Field Forces, Air National Guard, Air Force Reserve and Civil Air Patrol.
[1] 1950 security restrictions permitted the release of the total dollar value, by model but not the number of each model ordered.
1651 security restrictions prohibited the release in any form of USAF aircraft ordered for FY 1951.

SOURCE: USAF

power was not in North Korea and was immune from SAC attack. The air war settled down to the dirty, hazardous ground support and interdiction mission.

The Air Force used what it had—first F-82s, F-51s and F-80s (the only U.S. jet in action). The F-84, USAF's only approach to a jet ground support fighter-bomber, moved in. Appearance of the Russian-built transonic MiG-15 called for USAF's first team, the North American F-86 Sabre.

Superior airmanship, superior gunnery and more rugged construction have enabled the F-86s and their pilots to keep top score over the MiGs.

The Far East Air Force lives in the Korean skies only on sufferance of the Communists.

According to USAF officials, the Reds have 700-800 MiGs based across the Yalu River. FEAF has two F-86 groups—150 planes—in the theater. If the Communists committed their potential to action (instead of to combat training), normal attrition would destroy FEAF's two F-86 groups in short order—even if U.S. pilots maintained their present high ratio of kills.

The B-29s have been driven out of Korean daytime skies. According to McGraw-Hill World News correspondent Bill Jessup in Korea, MiGs actually have flown rings around the North American RB-45, the only U.S. jet bomber type in action. At low altitudes, enemy anti-aircraft has been murderous even to the fast F-86 and somewhat slower F-84.

► **Need New Methods**—In Korea, USAF fought with what it had. It suffered and it learned.

The B-36 is not obsolete, but it is at least approaching obsolescence. The B-29s' experience with flak and MiGs in Korea seems to indicate a need for more study of methods to use a 400-mph. bomber.

Air Force emphasis on the strategic bomber has not changed, because it cannot change. It is the firm conviction of the leaders of the Air Force that strategic bombing, by destroying an enemy's industrial power, can make victory possible in war—particularly in a war with a mighty land power whose armies are completely dependent upon industry.

And Air Force leaders have not changed another opinion held by their predecessors for years past. Strategic bombing is precision bombing. Criticism here and abroad of strategic bombing as mass slaughter of non-combatants is rejected by top Air Force officers.

USAF does not believe in bombing of cities to break down enemy morale. It will bomb only the parts of cities where industries are concentrated.

So with its belief in strategic bombing unshaken, but its faith in existing service bombers considerably modified, USAF has been creating a new bombing force, the elements of which will be:

USAF Aircraft Types On Order*

Company	Plane	Name
Beech	T-34	——
Boeing	B-47	Stratojet
	TB-50	Superfortress
	B-52	Stratofortress
	C-97	Stratofreighter
Chase	C-123	Avitrue
Convair	B-36	——
	T-29	——
De Havilland	L-20	Beaver
Douglas	C-118	——
	C-124	Globemaster
Fairchild	C-119	Packet
Grumman	SA-16	Albatross
Lockheed	C-121	Constellation
	F-94	——
	T-33	Shooting Star
Martin	B-57	Canberra
North American	F-86	Sabre
	T-2	Texan
	T-28	——
Northrop	F-89	Scorpion
Piasecki	H-21	——
Republic	F-84	Thunderjet
Sikorsky	H-19	——

*As of Jan. 1, 1952. Excludes research and experimental types.
SOURCE: USAF

• **Boeing B-47**, now in production at Wichita, but not yet delivered in operational quantities. Wichita schedules have been reduced, but the bomber will still be put into production by Douglas Aircraft at Tulsa and Lockheed Aircraft at Marietta, Ga. Both Tulsa and Marietta are more than a year away from producing the first article.

• **Boeing B-52**, prototype of which is near flight stage at Seattle.

• **Consolidated Vultee B-60**, swept wing all-jet version of the B-36 which is about ready for ground tests at Ft. Worth.

Those are the strategic bombers, all very fast and two—the B-52 and B-60—supposedly of intercontinental range. The main push is on the B-47, which is a medium bomber, but still bigger and faster than World War II heavies. With refueling, it might have intercontinental capabilities, but it most likely would be based at foreign fields.

The fact that the B-36 is in service in group strength despite its known deficiencies, gives the Air Force confidence to concentrate for the time being on medium bombers. If the foreign bases are available when needed, mediums will be called upon. If not, we still have the intercontinental groups. And, even if the bases are available, the heavies can still be used from those bases, with extra fuel replaced by bombs.

► **Must Weapons**—The renewed vigor behind the medium bomber is part of what Gen. Vandenberg, USAF Chief of Staff, recently called the precept of building "'must' weapons, not 'maybe' weapons." There are others in that category, stemming from the effect of Korea and NATO.

• **Ground support or light bombers**. During the lean budget days, the Air Force had to ease off procurement of this type of plane. In one sense it could afford to. The standing army at the time was not large enough to fight a major war, and until it fought, it would not need air support. And the strategic bomber was supposed to make commitment of large ground forces unnecessary. Korea provoked an increase in the army and brought about a requirement for fast, heavily armed ground support planes.

USAF's projected solution: the B-57A Canberra, being put into production by Glenn L. Martin Co. and the Douglas RB-66. USAF's version of the Navy's new A3D carrier-based attack plane. Both planes will be in the high-speed range; both presumably will be able to carry the atomic bomb or other atomic weapons.

• **All weather interceptors**. The Korean war, with its implied warning that world-wide war might be near and the consequent increases in U.S. defense spending caused USAF to give a new push to its first mission: defense of the U.S.

When Russia exploded its first atomic bomb, the Air Force then knew the potential enemy had the weapon for waging strategic air war. It had to assume Russia had, or soon would have, the means for using the weapon. To combat an attack directed at our industries, USAF has ordered and already has in service Lockheed F-94s and Northrop F-89s, with a greatly improved F-94C going into production.

• **Escort fighters**. The fast jet bomber has renewed the need for a fast, long-range fighter. To answer the need, USAF has ordered the McDonnell F-101, a faster, longer-legged version of the F-88. And the Republic F-84G is equipped for air-to-air refueling, as are later versions of the F-86.

But to fulfill these plans will take time. USAF goal is 143 wings, 126 combat wings, including a doubling of the number of tactical wings and 17 transport and miscellaneous wings. Originally, this force was to be ready by June of 1954. Now, since the recent schedule re-shuffle, it is planned for December, 1955.

USAF's present size is 90 wings. It has come a long way from the 48 wings in June of 1950 when the Korean war began, but perhaps not far enough. The Secretary of the Air Force recently said he could not state how many of the 90 wings are "modern" because they include a great many World War II types.

And it will be a year or more before World War II planes are finally replaced by planes suitable for a war today. When that time comes, the question will still remain: Will planes suitable for war today still be suitable then?

Naval Aviation

The United States Navy, one of the proudest services in the world, has regained its pride. But pride, and plans, are a poor substitute for modern combat planes when air power needs to be applied.

That the Navy has its pride and now can plan for planes is due to new and capable leadership. And the change in leadership traces back to one of the three events that has exercised such sway on our national military planning: Korea.

The outbreak of war in Korea exploded the myth that a nation can grow strong militarily by reducing its forces, and swept out of office the Secretary of Defense. The Secretary of the Navy soon followed him. The gags were removed from the mouths of Navy officials. They have been arguing persuasively their case for enlarged Naval air strength ever since.

But Navy officials learned their public relations lesson very well in the shambles of their attack on the B-36. Their case for Naval air now is couched more carefully. They are walking a tightrope and they know it.

► **Navy's Problem**—They have to show (1) That NATO, smaller atomic weapons and Korea have emphasized the need for Naval air, and (2) That Naval air should have a greater share of the defense budget because it was neglected so long it has grown weak. And they have to prove their twin case under handicaps.

NATO, in the first place, throws the Navy into direct conflict with the British tradition of the Royal Navy as the guardian of the approaches to Europe. The weakness of the Royal Navy's air arm has not weakened British pride. So an external factor must be considered in trying to assess the Navy's chances of getting more money if the emphasis in defense spending is to strengthen Europe.

NATO, in the second place, gives the U.S. facilities in Europe for land-based planes, which primarily means the Air Force.

The Navy, however, sees this as support for its case. The outstanding characteristic of a carrier is mobility. In theory, this makes for surprise in combat. Keep the enemy off balance and spread his forces thin, say Navy theoreticians, by sending in your land-based planes from one direction and your carrier-based planes from another. Then swing your carriers around to hit from another direction, and send your land-

U. S. Navy Aircraft Procurement

Class and Model*	Fiscal Year 1946	1947	1948	1949	1950
VA					
AM-1		44			
AM-1Q		6			
AO-2		156			
AO-2Q		22			
AD-3			125		
AD-3N			15		
AD-3Q			23		
AD-3W			31		
AD-4				236	
AD-4N				29	30
AD-4Q				28	
AD-4W				62	17
A2O-1					10
AF-2S			10	11	30
AF-2W			15	12	36
AJ-1			12	28	15
Total VA		228	268	407	150
VF					
F4U-5		223			
F4U-5N		58	40	120	80
F4U-5P		30			
F8L-1		30			
F8U-1				14	
F8D-1				28	
F8D-2					70
F8F-1B		128			
F8F-2		198	98		
F8F-2N		12			
F8F-2P		60			
F9F-2			47	317	73
F9F-3			54		
F9F-4					78
F9F-5				48	245
F9F-5P					6
FH-1	30				
F2H-1		30	20		
F2H-2				188	140
F2H-2N				14	
F2H-2P					84
FJ-1	30				
Total VF	60	784	282	727	733
H					
HOK-1					4
HTL-1			18		
HTL-2			12		
HTL-3				0	
HRP-1	10	10			
HRP-2			5		
HUP-1				7	15

Class and Model*	Fiscal Year 1946	1947	1948	1949	1950
HO3S-1			24	46	10
HO4S-1					10
HO5S-1					12
Total H	10	34	81	35	41
VP					
PBM-5A			24	12	
P4M-1		4	3	12	
P5M-1					4
PO-1W				2	
P2V-2		30			
P2V-3			52		
P2V-3W				30	
P2V-4				52	
P2V-5					40
AJ-1					—
Total VP	4	57	72	84	49
VO					
UF-1					35
Total VO					35
VR					
R4Q-1				8	
Total VR				8	
VT					
TO-1			50		
TO-2				10	10
Total VT			50	10	10
VU					
UF-1				6	
Total VU				6	
LTA					
ZPN				1	
Total LTA				1	
Total Program	74	1 103	726	1 289	1 010

Grand Total 1946 through 1950: 4,203.
*Meaning of class symbols: VA—attack; VF—fighter; H—helicopter; VP—patrol; VR—cargo, transport; VT—trainer; VU—utility; LTA—lighter-than-air.
SOURCE—U. S. Navy

Naval Aircraft on Hand[1]

Classification	1945	1946	1947	1948	1949	1950	1951
Operating USN[2]	36 300[3]	19 900[4]	7 000[4]	7,000[4]	6 000	4 900	6 300
Operating USNR					3 100	1 900	2 000
Support[5]	7 300	4 000	3 900	4 400	3 900	3 400	3 500
Reserve Stock[6]	8 900	9 200	4 500	2 600	2 000	4 500	2 900
Miscellaneous[7]	500	2 600	2 100	600	150	200	350
Total Inventory	39 600	25 400	17 500	10 200	14 050	14 200	13 950

[1] Includes planes assigned to Marine Corps, as follows: 1946—2,770; 1948—not available; 1947—779; 1948—922; 1949—907; 1950—587; 1951—669.
[2] Aircraft assigned to operating units and in operational pools.
[3] Aircraft awaiting or in delivery and rework.
[4] Aircraft in storage and other reserve stock.
[5] Includes aircraft awaiting disposition and experimental.
[6] Includes operating USNR aircraft.

based planes from still another approach

▶**AF Rebuttal**—That is a sample of the Navy's new, reasoned arguments for carrier based as well as land based air forces. But there are still some Air Force officers who wonder if the "floating bases will still be floating when you need them."

The Navy's reply is that carriers are not as vulnerable as Air Force people believe. Navy men still saw no fast U. S. carrier was sunk by land based aircraft during the war, that submarine torpedoes accounted for the carriers lost either directly or by crippling them for polishing off by carrier-based air attack. And Navy believes it has improved its anti-submarine tactics.

Not even atome bombs are as dangerous to a carrier task force as is popularly believed. Navy spokesmen say. Normal ship deployment in a combat theater is sufficient to limit the destructive power of the bomb to one or two ships, they explain. The atomic war era, the Navy believes, has helped its case.

Smaller atomic weapons can be carried by smaller planes. And with the possibility that the U. S. may lose its bases abroad—or not be permitted by political considerations to use them for launching an atomic air strike—carrier based planes might be the only way to push home an atomic attack.

▶**Navy's View**—Naval Aviation News, official publication on the Navy, sums up the thesis: "Both aircraft carriers and strategic bombers have their uses and are necessary. Both should be allowed to continue their development unhindered."

If the Navy's arguments on the need of Naval aviation are accepted, the Korean war furnishes excellent testimony for the second premise—that Naval aviation has been neglected. Naval aircraft are not in the running in 'MiG Alley."

The Douglas AD Skyraider is perhaps the best airplane in the world pound for pound for its task. The Chance Vought F4U Corsair is perhaps still the fastest piston engine plane in the world. But present Navy jet fighters are outclassed.

Vice Admiral John H. Cassady, Deputy Chief of Naval Operations for Air, told "U. S. News & World Report" that "The MiG-15 is a very short range, very short endurance, strictly defensive interceptor" and that the Navy's McDonnell F2H Banshee and Grumman F9F Panther have twice the range and twice the endurance of the MiG. Such statements duck the main point.

The MiG was designed to be an interceptor and fulfills that job superbly. If the Navy ever expects to send bombers over enemy territory, the escorting fighters will have to ward off interceptors the equal of or better than the MiG which, Adm. Cassady concedes, flies and climbs faster than Navy jets now in service.

The U. S. Navy has the world's best piston engine air force in a jet engine age.

The unfortunate part is that it isn't the Navy's fault—at least not the fault of the present leaders of the Navy.

▶**Revival Begins**—When the late Adm. Sherman became Chief of Naval Operations he quietly began to re-assert the Navy's case with patience and political finesse. A Naval air arm that was supposed to be concentrating only on anti-submarine measures began once more to make plans for a strong air striking force.

Korea, in addition to removing the gags from the mouths of Navy officers, removed some of the barriers to greater appropriations. Now Navy has in production or nearing that stage a stable which will include some of world's finest jet aircraft.

▪ **Fighters**. The Navy believes that no planes will be better for interceptor work than the Douglas F4D Skyray and the Chance Vought F7U-3, both of roughly the same all wing configuration and designed for very rapid rate of climb.

In the escort class the McDonnell F3H Demon and North American FJ-2 variant of the F-86 should be as fast as any existing plane, and the Grumman F9F-6 Cougar only slightly slower.

▪ **Bombers**. The Douglas XA3D-1 at 77,000 lb. will be the largest carrier-based bomber and probably the fastest, with a top of 600/700 mph. It is so promising the Air Force also is buying it under the designation RB-66.

North American's XA3J turboprop bomber will be another heavy carrier based plane with long range.

▶**Several Years Away**—Service use of most of these types is several years away. In addition to the long lead time in aircraft building, there is the long construction period in carrier building, for planes such as the A3D are designed for the new Forrestal-class carrier. In the meantime Navy must hope that quantity can outweigh deficiencies in quality.

In strengthening its aviation since the outbreak of the Korean war, Navy has advanced closer to its goals than has the Air Force. Planned Navy strength is 16 carrier air groups, plus 49 support and 30 Marine squadrons.

At present, Navy has 14 carrier air groups. It will have 10,000 planes by June of this year and reach its planned strength at the end of June, 1953—two years before USAF reaches its goal of 143 wings.

So the earliest that one of America's military air services can be at full strength is 18 months from now. Defense Mobilizer Charles E. Wilson several times has said that not a single plane that was not in production before the Korean war has seen action in that conflict. And that war is more than 18 months old.

On June 24, 1950, the Air Force and Naval aviation, as far as anyone could foresee, had years to get ready for war. The next day the North Koreans moved, and the get ready time had been cut to hours.

The "ready" dates of June, 1953, and June, 1955, might be all right for wars of politically limited objectives such as the Korean conflict. The get-ready period for anything worse still depends on the potential aggressor's estimate of the potency of the Strategic Air Command. USAF—W.K.

U. S. Navy Aircraft Types On Order*

Manufacturer	Plane	Name
Douglas	AD	Skyraider
	F3D	Skyknight
	F4D	Skyray
	R3D	Liftmaster
Grumman	AF	Guardian
	F9F	Panther
	UF	Albatross
McDonnell	F3H	Demon
North American	AJ	Savage
	FJ	——
Chance Vought	F7U	Cutlass
	AU	Corsair
Lockheed	P2V	Neptune
	R7O	Constellation
	TO-2	Shooting Star
Martin	P5M	Marlin
Consolidated	R3Y	——
Fairchild	R4Q	Packet
Piasecki	HUP	Retriever
Hiller Helicopter	HTE	——
Bell	HTL	——
Sikorsky	HO5S	
	HR5	
Kaman	HOK	
Goodyear	ZFN	——
	ZPK	——

* As of Jan. 1, 1952. Excludes aircraft which have not been publicly announced.

SOURCE: U. S. Navy

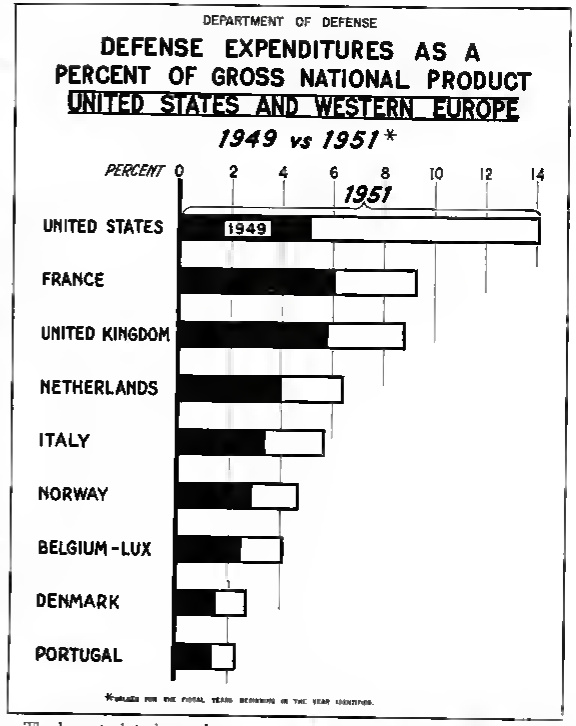
Carriers in Service 1945-1951

Year	CV	CVL	CVE	CVB
1945	30	8	70	0
1946	12	2	10	3
1947	10	2	5	2
1948	8	2	7	3
1949	9	3	7	3
1950	4	4	4	3
1951	1	3	10	0

SOURCE: U. S. Navy

NATO: Too Little Money, Too Many Lands

- If the U. S. wants Pact to work it must foot the bill, because Europe's economy has no fat left.
- But even money doesn't solve all problems. You have to meld varied tongues and customs.



The spirit of NATO air power is willing, but its flesh is weak.

The idealistic thinking which formed the North Atlantic Treaty Organization in the postwar years has suffered in translation to tangible progress.

Contributing to this breakdown are:

- Lack of authority for NATO branches.
- Lack of standardization of equipment.
- Lack of money.

But basically, it all boils down to this single theorem. The countries which need NATO most can least afford it.

And there is a single corollary to that theorem. If the United States expects help from NATO in its policy of containment of Russia, it must continue to plug the gaps with money and materiel.

▶**No Strain**—Even though our contribution to Mutual Defense Assistance Pact military and tops every other country's—either by dollars or by percentages—that particular spending does not exactly strain our national economy. But in England, France, Italy—right down the list of MDAP signatories—every dollar equivalent which goes to meet NATO military commitments means less luxuries (if there are any left in those countries), less consumer goods.

There isn't much hope of changing this condition, either. Primarily, our MDAP expenses are the premium on an insurance policy against external communism. But internal communism—where a country's economy is so weakened that it easily backslides into the Red way—also has to be considered. And that's why we will have to make up deficiencies which occur all along the line. That's why our MDAP dollars go not only to thwart open Communist aggression, but to prevent losing a country to Russia by default.

▶**Other Weakness**—Once you get away from the financial basis for the weakness of NATO, you still have to consider the organization and activity. And as an organization, NATO has little power other than to advise.

What happens? Take the case of the British aircraft industry. NATO would like to see that industry expand; the growth would help bolster Europe's air strength as well as British economy.

But NATO can recommend expansion all it wants to, and get nowhere. The biggest obstacles to that expansion are housing and labor direction, both internal political issues wherein NATO has virtually no influence.

▶**The Foreign View**—There are still other difficulties within the organization plan of NATO. From London McGraw-Hill World News bureau chief Nat McKitterick writes:

"While NATO's military brass in Paris has been wrestling with the problems of integrating existing NATO air power, the civilian high command in London has been fumbling badly with the problem of integrating production plans for future NATO air power. It is generally true that so far all the steps taken in the direction of this integration have been completely outside the structure of NATO.

"And as one European official close to NATO air power matters commented: 'We know what a big hole we've got hold of. What we have to do now is build up an organization that really does something.'

"At Lisbon last week NATO aircraft production officials documented the well-known fact that there is a very serious gap between military requirements and available production. U. S. officials complained that they have had $500 million for almost a year now to spend on off-shore purchases of military and air equipment and supplies in Europe, but they've only been able to spend $20 million. The British and others complained that NATO's timetable for a force in being by the end of 1954 means that as far as they are concerned, any aircraft that isn't in production now isn't going to do that force any good. They want more time.

"Nobody who knows what goes on inside NATO's Defense Production Board believes that the organization as it is now set up has any chance of solving these problems. NATO is cursed with being a purely advisory body when its work depends on hard and fast governmental decisions. It is further hamstrung by conflicting views.

"The DPB and its younger brother, the Finance & Economic Board in Paris, will probably be merged into a group of committees responsible to the council.

"This will increase the chances that the half-dozen experts of NATO's Aircraft Production division will accomplish something.

"The question of timing is a long way from being solved, though. U S officials are split among themselves over whether or not aid money should be spent to procure aircraft which won't be available before 1955 56. Such a case is the British Blackburn & General GAL 60 freighter not yet ordered by the RAF. NATO airmen want the freighter. The RAF want it. But there isn't any available capacity to build it in Britain now.

"Should the U.S. spend money equipping new British capacity for building the GAL 60?

"That kind of question involves deciding how long you think rearmament should go on. Some U S. officials have given up entirely the idea of getting more aircraft in Europe for NATO. Said one high U S official, 'We can produce planes faster and cheaper. Why should we spend money buying them in Europe?' "

Below the organizational and planning levels are the working groups. In NATO, one of their jobs is to integrate the various national air forces into one effective unit which will be NATO air power, and not just a few additional wings of the U S Air Force.

This is no simple task.

But to tackle it, there is a group of officers under USAF Lt Gen. Lauris Norstad at the headquarters of Allied Air Forces Central Europe (AAFCE) in Fontainebleau, France.

▶ The AAFCE View—And from there Ross Hazeltine, McGraw-Hill World News Paris bureau chief, writes:

"If anyone thinks building an air force to guard the West is simply a matter of gathering together enough men and planes, he should talk with the officers at this headquarters of Allied Air Forces, Central Europe.

"From Lt Gen. Lauris Norstad, the Commander-in-Chief, right on down they will tell you they aren't worried so much about strength figures as they are about how well AAFCE's air power can be applied against an enemy when the cards are down.

"U S air planners in Europe point out that in Korea American flyers have scored a continuous and impressive string of victories over the Communists, even when they were outnumbered 4 or 5 to 1. That, they say, is proof enough that air power is more a matter of tactics, training and especially "back-up," than of numbers.

"But in an allied air force composed of squadrons from six or eight nations, these are exactly the weakest points. There are bound to be serious and extremely hard-to-handle differences in equipment, training, tactics, language and techniques in maintenance or communication. Add to these differences the handicaps that several democratic systems must face in comparison with the total authority of a single dictator and you will have a measure of the task of building an Allied Air Force under the North Atlantic Treaty Organization capable of fulfilling its mission.

"Here's what they are doing about it:

"I. STRENGTH. Although they insist mere numbers are not the heart of the problem, or even the most important part of it, the West's air generals recognize that the present ratio of estimated Russian and actual Western air strength is all out of proportion. AAFCE won't say how many planes the West could put in the air to meet Russia's 8,000. But in Operation Cirrus last September—the biggest Western air maneuver up to that time—something over 1,000 Allied planes were airborne at one time or another.

"That's just not enough. The West must at least double its strength in planes and trained men this year. Good progress here is being made. Training programs stepped up after Korea are turning out the necessary skilled airmen. And thanks to MDAP, American F-84's now are flowing into Europe in substantial numbers. Nearly all NATO nations have some, and are getting more regularly.

"II. AIRFIELDS. The airfield construction program in Western Europe is lagging seriously. Some airfields have been built and put in operation. Still more are under construction. But there are not enough to match the Russian network of airfields in Eastern Europe or to give the Allied Air Forces the flexibility required.

"There are several reasons for this. One is the difficulty a politically weak government—as in France—has in forcing farmers off their land to provide airfield sites.

"Another is the difficulty and expense of building new airfields or expanding existing fields in the crowded areas of Northern France, Belgium and Holland. In several instances AAFCE has had to accept less desirable sites for fields because the more desirable locations would have meant bulldozing too many homes or redirecting some main highway or railroad.

"A third is finance. Particularly in France, the government just can't scrape together enough money to carry the French share of an airfield building program on the scale AAFCE and Eisenhower believe is necessary.

"III. COMMUNICATIONS. Landlines used in Cirrus totaled 55,000 mi.—still they were barely adequate. Most of them, too, were merely hired for a week from civilian operating companies.

"Work on a military landline network is going forward and will be in condition to provide considerable relief from dependence on civilian lines before the end of the year. Progress also is being made at ironing out the difficulties of language and the inter-connection of various national types of teleprinters and other equipment.

"IV. STANDARDIZATION. An essential if the Allied Air Forces are to have anything like the necessary flexibility is an arrangement that would allow any Allied plane to land on any Allied airfield and get fuel or first-line maintenance. But look at the complications.

"AAFCE uses four different types of fighter planes—the F-84, F-86, Vampire and Meteor. Take the F-84 as an example. It requires a general maintenance kit of 85 different tools. In addition, 50 more tools of a specialized nature and 35 various machines are needed for more complicated repair work.

"To maintain competent mechanics and adequate repair equipment for every type of Allied plane at every Allied airfield would be a tremendously expensive business. But a lot can be accomplished at little cost.

"Starting with the four generally used fighter planes, experts are working to put together one consolidated tool kit which will contain everything needed to administer first and second echelon maintenance to any of the four planes.

"V. ORGANIZATION. In organization and tactical doctrine, Allied Air Forces have profited considerably from the experience in Korea. They are organized pretty much on the pattern that proved successful in Korea. And a considerable number of officers with Korean experience have been assigned to Europe.

Lt Gen. Norstad, Commanding Air General for the central sector, has responsibility extending over the area from the base of Denmark to the Alps. His command is divided between two tactical air forces—the 2nd Allied Tactical Air Force under Air Marshal Sir Robert M. Foster in the North and the 4th Allied Tactical Air Force under Maj. Gen. Dean C. Strother in the southern half of the central sector.

"Behind the tactical air forces are the air defense organizations of France, Belgium, the Netherlands and Great Britain. These organizations are in good operating condition with equipment in place and well-designed underground operations centers."

Estimated Aircraft Production, 1951

Month	NUMBER			AIRFRAME WEIGHT 000 LB.			VALUE (SALES) MILLION $			TOTAL NUMBER	TOTAL WEIGHT	TOTAL VALUE[1]
	Mil	Pers.	Transp.	Mil	Pers.	Transp.	Mil.[2]	Pers.	Transp.	Units	000 Lb.	Mill $
January	N.A.	255		N.A.	200	154	N.A.	4.9		N.A.	N.A.	363
February	N.A.	239		N.A.	191	102	N.A.	3.7		N.A.	N.A.	
March	N.A.	261	11	N.A.	234	83	N.A.	1.0	1.7	N.A.	N.A.	
April	N.A.	231	15	N.A.	195	301	N.A.	1.4	12.0	N.A.	N.A.	468
May	N.A.	233	15	N.A.	194	395	N.A.	1.5	9.2	N.A.	N.A.	
June	N.A.	208	13	N.A.	169	287	N.A.	1.1	7.0	N.A.	N.A.	
July	N.A.	188	5	N.A.	194	215	338	1.1	6.3	N.A.	N.A.	445
August	N.A.	166	11	N.A.	132	185		1.1	4.4	N.A.	N.A.	
September	N.A.	184		N.A.	126	609		0.9	4.6	N.A.	N.A.	
October	N.A.	124		N.A.	93	134	N.A.	0.7	3.1	N.A.	N.A.	N.A.
November	N.A.	120	25	N.A.	108	408	N.A.	0.5	9.6	N.A.	N.A.	N.A.
December	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
TOTAL	4,500[3]	2,400	170[3]	54,000[3]	2,000	3,000	1,509[3]	13.9	57.9	7,970[3]	99,000[3]	2,000[3]

N.A. Not available.
[3] Estimate.
[2] Includes parts but excludes value of engines and propellers for military airplanes.
[1] Includes twin-engine executive transports.

SOURCE: Bureau of the Census, Facts for Industry, Series M3-1 M4D, M4E. *Table by Rudolf Modley*

How to Measure Air Power by Statistics

By Rudolf Modley

There are quite a few statistical tables in this issue and this writer is responsible for some of them. It is, therefore, only fair to give the reader an idea how right or wrong these figures may be, how they were arrived at and how they might be used—and misused.

The most important fact on aircraft production statistics today is that they have been put behind an iron curtain of security. The wisdom of this action is highly debatable, but this is not the point at issue here. What we have to deal with is the fact that we are now in the second year in which no official data on military production have been published.

The further we move away from the last fixed points, established by the best methods of measurement available to us, the larger the margin of possible error gets. Some of the data estimated by the writer may, therefore, be quite a bit off the mark. How far off, we'll only be able to tell when the curtain is lifted again and we shall be able to go back and compare the facts with the

U. S. Engine Production

Year	Military		Civil		Total		Value
	Number	Horsepower[2] (million)	Number	Horsepower (million)	Number	Horsepower[2] (million)	$-million
1940	22,667[3]	15.8	7,500[3]	1.0[3]	30,000	16.8[3]	195
1941	58,181	44.3	9,000[3]	1.0[3]	65,000[3]	46.6	436
1942	138,089	147.6			138,089	145[3]	1,314
1943	227,110	262.3			227,110	263[3]	2,528
1944	257,600[3]	310[3]			257,000	370[3]	3,076
1945	109,650	150[3]	2,900[3]	N.A.	112,000	150[3]	1,750[3]
1949	2,585	0[3]	40,822	12.0[3]	43,404	21.2	N.A.
1947	3,605	17.1	18,351	5.1	21,150	22.2	460[3]
1948	N.A.	22.0	9,039	2.8	N.A.	24.8	N.A.
1949	N.A.	40.4	3,987	1.2	N.A.	40.1	N.A.
1950	N.A.	85.0[3]	4,314	1.6	N.A.	86.5[3]	700[3]
1951	N.A.	100.0[3]	4,600[3]	2.6	N.A.	102.6[3]	1,100[3]

N.A. Not Available.
[3] Estimated.
[2] Thrust of jet engines converted to horsepower.
[1] About $50 million of this was for research and experimental work.

SOURCE: Aviation Facts and Figures, Census Reports.
Table by Rudolf Modley

1951 Civil Engine Production

Month	Number	Horsepower (thousands)	Sales (Million dollars)
January	436	151	2.2
February	396	176	2.2
March	356	180	2.2
April	409	200	2.5
May	384	210	2.7
June	362	186	2.1
July	350	194	2.0
August	391	150	1.7
September	460	191	2.4
October	343	17	0
November	368	193	N.A.
December	N.A.	N.A.	N.A.
TOTAL	4,600	2,000	25.6

N.A. Not available.
SOURCE: Bureau of the Census, Facts for Industry, Series M4A.

Aircraft Production History

1909–1939

Year	NUMBER			VALUE (Million Dollars)		
	For U. S. Military	Civil and other	Total	Military Aircraft	Civil Aircraft	Total Incl. Parts
1909	1		1	N.A.	N.A.	N.A.
1910	N.A.		N.A.	N.A.	N.A.	N.A.
1911	11		11	N.A.	N.A.	N.A.
1912	16	29	45	N.A.	N.A.	N.A.
1913	14	29	43	N.A.	N.A.	N.A.
1914	15	34	49	N.A.	N.A.	9
1915	26	182	178	N.A.	N.A.	N.A.
1916	142	269	411	N.A.	N.A.	N.A.
1917	3 919	176	2 140	N.A.	N.A.	N.A.
1918	13 991	26	14 030	N.A.	N.A.	N.A.
1919	682	99	780	N.A.	N.A.	14 4
1920	256	72	364	N.A.	N.A.	N.A.
1921	380	48	437	N.A.	N.A.	7 4
1922	226	37	263	N.A.	N.A.	N.A.
1923	657	86	743	N.A.	N.A.	13 1
1924	317	60	377	N.A.	N.A.	N.A.
1925	680	344	788	N.A.	N.A.	12 8
1926	478	705	1 183	10 5	N.A.	17 1
1927	609	1 386	1 995	14 1	N.A.	30 9
1928	647	2 493	4,340	31 8	18 2	64 1
1929	779	5 414	6 193	19 4	51 5	91 1
1930	886	2 601	3,487	21 8	17 0	60 8
1931	853	1 947	2 800	20 4	13 8	42 6
1932	800	806	1 606	19 8	5 2	34 9
1933	331	993	1 324	14 6	10 9	33 4
1934	380	1 232	1 612	14 0	20 3	43 9
1935	336	1,374	1,710	17 6	10 9	42 5
1936	885	2 152	3 010	42 4	19 9	73 1
1937	896	2 916	3 773	51 0	34 5	114 1
1938	925	2 898	3 823	N.A.	N.A.	109 8
1939	921	4 200	5,600	N.A.	N.A.	867 9

1940–1951

Year	NUMBER			VALUE (Aircraft, Engines, Propellers & Parts) Million Dollars		
	Military	Civil	Total	Military	Civil	Total
1940	6 613	6 795	12 804	600*	50*	650*
1941	19 433	6 864	26 297	1 804	50*	1 854*
1942	47 836		47 836	5 817		5 817
1943	85 898		85 898	12 814		12 814
1944	96 318		96 318	16 047		16 047
1945	49 744	2 057	49 701	9 000*	10*	9 010*
1946	1 250	35 001	36 670	800*	200*	1 000*
1947	2 100*	16 017	17 717*	750*	250*	1 000*
1948	2 300*	7 302	9 602*	1 125*	175*	1 300*
1949	2 500*	3 600*	6 100*	1 300*	200*	1 500*
1950	3 000*	3 526*	6 526*	2 100*	240*	2 340
1951	4 500*	2 570*	7 070*	3 000*	350*	3 350*

N.A. Not Available.
* Estimated.
Military values 1940–1950 based on 1952 unit cost

SOURCES *Aviation Facts and Figures*
Statistical Handbook of Civil Aviation 1949
Census Reports
Table by Rudolf Modley.

estimates which are published here

There are some indications that the military will release data after a certain time lag has occurred. Originally it had been hoped that this lag would not exceed six months and it is very hard to see any valid reason why it should extend beyond a year

At present the writer feels fairly certain that the margin of error in the tables in this issue will rarely exceed 10%—upwards or downwards. It may be important to state that the writer has had no access to any current classified production statistics of any kind in making up his estimates and has not checked them with anybody who has

With this preliminary warning we may now enter behind the iron curtain and introduce the leading characters in the cast. As we shall see, they are all very complex personalities who hide many strains and weaknesses behind a seemingly simple and open exterior

Number of Units

By now, most students of the subject are aware that "number" of airplanes is a very poor measuring stick of production or fleet strength. The reason for this is that when units alone are used, one 1000-lb. liaison plane counts just as much as a 100,000-lb. bomber. In times when the general composition of production remains the same—that means when the proportion of personal planes, transports, fighters, bombers, etc., is fixed—the error may not be too serious

But in times like these when the general composition of production must be shifting rapidly, the number of units produced becomes more or less meaningless if detailed breakdowns of types are not given at the same time

In the civil field we find a reduction in the number of personal planes

Airframe Weight Produced

Year	Weight in Million Pounds (Excl. Spares)		
	Military	Civil	Total
1940	23 1	4 0*	27 1*
1941	76 1	4 0*	80 1*
1942	253 1		253 1
1943	645 9		645 9
1944	963 2		963 2
1945	900 0*	1 5*	541 5*
1946	12 9	25 5	38 4
1947	11 4	17 9	29 3
1948	25 2	10 1	35 3
1949	29 8	9 7	38 5
1950	37 0*	6 0*	43 0*
1951	34 0*	5 0*	39 0*

* Estimated.

SOURCES *Aviation Facts and Figures, Census Reports; Table by Rudolf Modley*

(which weigh little) produced but no comparable reduction in the production of transports (which are fairly heavy)

▶**No Indication**—In the military field we may assume an increase in the number of trainers produced as the size of the Air Forces increases. The shift in strategic concepts and the rate of development of different types of military aircraft seems to indicate that in the Air Force the relative position of the bomber has been weakened to the advantage of both fighters and trainers. The helicopter too, is probably beginning to show up in relatively greater numbers

The indicated increase of 50% in the number of military aircraft produced is therefore, not truly indicative of the increase in military strength while the decrease of about 30% in the number of civil aircraft is in no way indicative of the decline in civil production.

Airframe Weight

To overcome the shortcomings of measurement by number of units, the concept of "airframe weight" was developed in the 1940s. Here's the military effectiveness of the airplane for its assigned task and the effort which goes into its production is measured in a much more realistic fashion

▶**One Up, One Down**—Yet, it should be pointed out that "one pound of airframe weight" is as little a fixed unit of measurement as "one dollar" is a fixed measurement of value. While the dollar is undergoing a constant decrease in value as the inflationary process develops, so the pound of airframe weight is undergoing a constant increase in value as engineers and scientists strive constantly to get more power, more speed, more load, more altitude out of less and less weight.

This is true in spite of the fact that until recently the average airframe weight per military plane has gone up. It went up at a much slower rate than the increase in efficiency. It is unfortunate that this increase in efficiency can not be measured with a measuring stick as simple as that of "airframe weight."

It appears to the writer that if such a new measuring stick could be found a lot of the alarm about the increase in cost per airframe weight would evaporate. The cost per pound naturally goes up rapidly when we measure something that is subject to a deflationary process (the pound of airframe weight) with a measuring stick undergoing an inflationary process (the dollar).

In the table on average airframe weight of military aircraft we have estimated a reduction in average weight for the first time in many years. This reversal which we assume to have taken place is due to the different "mix"

U. S. Aircraft Industry

Company	Location	Plant Area (Sq. Ft.)	Plant Employment	1951 Sales*	Backlog*
Aeroproducts div. GM	Vandalia, Ohio	600 000	5 000	N.A.	N.A.
Allison Div. GM	Indianapolis	4 000 000	16 000	N.A.	N.A.
Beech Aircraft Corp	Wichita	1 600 000	3 000	844 000 000	$170 000 000
Bell Aircraft Corp	Buffalo & Niagara Front'r Areas, N.Y.[1]	1 382 000	16 500	50 000 000	375 000 000
	Fort Worth[1]	384 000	700		
Boeing Airplane Co	Seattle-Renton Wash.	5,472,000	38 000	325 000 000	1,250 000 000
	Wichita	3 218 200	25 000		
Cessna Aircraft Co	Wichita	942 000			
	Hutchinson Kan.	138 000	4,000	26 000 000[2]	78,000 000
	Prospect Kan	150 000			
Chase Aircraft	West Trenton, N.J.	110 000	1 000	N.A.	130,000 000
(Kaiser-Fraser Corp.)	Willow Run, Mich.	1,300 000	12 000		
Consolidated Vultee Aircraft Corp.	San Diego, Calif.	3,548 000	23 000	322 000 000	900 000 000
	Fort Worth	4,473 000	30 000		
Curtiss-Wright Corp	Caldwell, N. J.	600 000[3]	5,100[3]	119 000 000	1,000 000 000
(Wright Aeronautical div.)	Woodridge, N. J.	2 828 000[4]	18,000[4]		
Douglas Aircraft Co	El Segundo, Calif.	2,040 386	12 000		
	Long Beach, Calif.	2 419 000	12 987		
	Santa Monica, Calif.	2 901 280	11 884	153 371 814[5]	1,092 098 883[5]
	Tulsa, Okla.	2 000 000	3 062		
Fairchild E&A Corp.	Hagerstown, Md.	905 000	5 000	N.A.	N.A.
	Farmingdale, N. Y.[1]	1 000 000	2 500		
General Electric Co.	West Lynn, Mass.	1 100 000	7 000		
(Air Cos Turbine div.)	Lockland, Ohio	3 000 000	8 100	N.A.	N.A.
Grumman Aircraft Engineering Corp.	Bethpage, N. Y.	2 484,210	9 275	120 000 000	90,000 000[6]
Hiller Helicopters Inc	Palo Alto, Calif.	136 000	836	5,000 000	10,000 000
Kaiser Aircraft Corp	Wintsor Locks, Conn.	183 000	780	N.A.	18 000 000
Lockheed Aircraft Corp	Burbank, Calif.	5 350 000	26 000		
	Marietta, Ga.	5 000 000	11 000	345 000 000	1,350 000 000
Glenn L. Martin Co	Middle River, Md.	4 000 000	21 000	90 000 000	900 000 000
McDonnell Aircraft Corp	St. Louis	1 000 000	5 000	66 623 014[7]	300 000 000[8]
North American Aviat on Inc.	Downey, Calif.	1 918 434	8 311		
	Fresno, Calif.	250 379	592		
	Los Angeles	2 860 133	19 023	173 443 276[9]	657 600 000
	Columbus, Ohio	2 463 374	13 271		
Northrop Aircraft Inc.[1]	Hawthorne, Calif.	2 000 000	25 000	128 000 000	350 000 000
Pitcairn Helicopter Corp.	Morton, Pa.	000 000	3 300	28,000 000	180 000 000
Republic Aviation Inc.	Farmingdale, N. Y.	3 050 000	18 000	113,000,000	900,000 000
Ryan Aeronautical Co.	San Diego, Calif.	730 000	1 500	22,000 000	90 000 000
United Aircraft Corp.	East Hartford, Conn.	2 947 000*			
(Chance Vought Division)	Dallas	1 800 000*			
(Hamilton Standard Div.)	East Hartford, Conn.	500 000*	25 000	285 811 291[10]	1 800 000 000
(Pratt Whitney Division)	Southington, Conn.	300 000*			
(Sikorsky Division)	Bridgeport, Conn.	325 130*			
TOTALS		85 937 085*	441 425	$2 864 101 815[11]	$13 426 243 060

*AVIATION WEEK estimates unless otherwise indicated.
[1] Includes several plants.
[2] Includes several plants.
[3] As of Oct. 17 1951.
[4] Includes all Allison defense production.
[5] Total for fiscal year.
[6] As of Nov. 30, 1951
[7] Figures include Anaheim division and plants at Holloman AFB, N. M., Edwards AFB Calif. Ontario, Calif
[8] Figures as of Sept. 30, 1951.
[9] Includes plants at Bay Shore and Wyandanch, N. Y.
[10] Excludes Letters of Intent for approximately $583,000,000.

SOURCE *Manufacturers reports to AVIATION WEEK*

which we think has taken place. With more trainers, fighters, liaison planes and helicopters produced, we should not be surprised to learn that the decrease in average weight had been even more severe. If it were, our estimate of 54 million lb. of military airframe weight produced in 1951 would have to be reduced correspondingly.

Sales

If numbers are a poor measuring stick and "airframe weight" has its shortcomings, "sales" is the most unleading of all the means used to measure activity in the industry.

This is not only due to the decrease

Floor Space

(Millions of square feet)

Year	Airplane	Engine	Propeller	Total
Jan. 1939	7 5	1 7	3	9 5
Sept. 1941	31 8	10 7	1 7	44 2
Dec. 1943	119 4	54 2	6 8	178 4
1944	39 9	13 5	1 6	54 1
1950*	47 5	14 0	2 0	65 5
1951*	84 8	30 2	3 5	120 2

* Estimated.

SOURCES *Aviation Week Survey and Annual Reports; Table by Rudolf Modley*

Unions in the Aircraft Industry

COMPANY	LOCATION	UNION
Aircraft Assembly		
Aeronca Aircraft Corp	Middletown Ohio	Ind.
Beech Aircraft Corp	Wichita	IAM
Bell Aircraft Corp.	Buffalo and Niagara Frontier area N Y	UAW
Bellanca Aircraft Corp.	New Castle, Del	UAW
Boeing Airplane Co	Seattle, Wichita	IAM
Cessna Aircraft Co.	Wichita	IAM
Chase Aircraft Co	West Trenton N J	UAW
Consolidated Vultee Aircraft Corp	San Diego Fort Worth	IAM
Douglas Aircraft Co	El Segundo, Calif. Santa Monica Calif. Long Beach Calif	IAM UAW
Fairchild Engine & Aircraft Corp.	Hagerstown Md	UAW
Goodyear Aircraft Corp	Akron	UAW
Hiller Helicopters, Inc	Palo Alto, Calif	IAM
Lockheed Aircraft Corp	Los Angeles	IAM
Glenn L. Martin Co	Middle River Md	UAW
McDonnell Aircraft Corp	St. Louis	IAM
Piper Aircraft Corp.	Lock Haven, Pa	IAM
Republic Aviation Corp	Farmingdale N Y	IAM
Ryan Aeronautical Co	San Diego Calif	UAW
Taylorcraft Inc.	Conway Pa	AEA
Temco Engineering & Mfg Co	Dallas.	UAW
United Aircraft Corp. (Sikorsky division) (Chance Vought division)	Bridgeport, Conn Dallas	UAW UAW
Aircraft Engines		
Aerojet Engineering Corp.	Azusa, Calif	IAM
Avco Manufacturing Co. (Lycoming-Spencer division)	Williamsport Pa	UAW
Continental Motors Corp.	Muskegon Mich	UAW
Curtiss-Wright Corp (Wright Aeronautical div.)	Wood Ridge N J	UAW
Fairchild Engine & Airplane Corp	Farmingdale N Y	UAW
General Electric Co. (Aircraft Gas Turbine division)	West Lynn, Mass Everett, Mass	IUE IUE
General Motors Corp (Allison div.)	Indianapolis	UAW
Jacobs Aircraft Engine Co	Pottstown, Pa	IAM
United Aircraft Corp. (Pratt & Whitney division)	Southington Conn	IAM
Aircraft Propellers		
Curtiss-Wright Corp	Caldwell N J., Clifton N J	IAM
General Motors Corp. (Aeroproducts division)	Vandalia, Ohio	UAW
United Aircraft Corp. (Hamilton Standard division)	East Hartford, Conn	IAM

NOTE. IAM—Intrnl. Assn. of Machinists (AFL), UAW—United Automobile Workers (CIO), AEA—Allied Employees Assn. (Ind.)

SOURCE Department of Labor Bureau of Labor Statistics

Dispersion of the Aircraft Industry

Year	West Coast	East Coast	West Central	East Central	Total Coast	Total Central
June 1940	45 9%	48 1%	2 3%	3 7%	94 0%	6 0%
June 1942	38 0%	35 0%	10 0%	21 0%	68 3%	21 7%
June 1943	26 2%	31 3%	14 6%	27 9%	57 5%	42 5%
June 1944	21 5%	28 0%	17 5%	33 1%	54 4%	49 6%
Early 1952	32 0%*	24 0%*	22 0%*	22 0%*	56 0%*	44 0%*

* Estimated

1940-1944 on the basis of employment.

1952 on the basis of floor space

SOURCES War Plant Disposal—Aircraft Plants Phase. Hearing U S Senate, Oct 30 1945 AVIATION WEEK Survey of Floor Space Annual Reports of Manufacturers. Table by Rudolf Modley

Average Weekly Earnings

Year	Aircraft and Parts	Aircraft excl. Engines			Aircraft Engines
1914	N.A.	$10 40			N.A
1918	N A	26 60			N A
1921	N A.	21 70			N.A
1923	N.A.	30 00			N.A.
1927	N A.	29 81			N A.
1929	N.A	28 68			N A
1931	N A	20 19			N A
1933	N A.	23 27			N A
1935	N A.	25 10			N A
1937	N.A.	27 83			$27 63
1939	N.A	30 34			36 38
1941	N.A.	37 75			47 34
1943	N A.	49 70			59 81
1945	N A.	54 37			67 68
		Airc.	Airc. Props and Parts	Other Airc. Parts & Equipt. (ex. eng.)	Airc. Engines and Parts
1947	$54 68	$33 63	$39 63	$68 50	$66 30
1948	61 21	60 21	12 13	63 60	63 40
1949	63 62	62 69	66 83	66 04	65 24
1950	68 36	67 15	73 65	70 91	71 40
1951*	76 65	76 38	68 27	76 10	35 66

N A. Not available

* Estimated.

Table by Rudolf Modley

SOURCE Bureau of Labor Statistics.

Average Weekly Hours

Year	Aircraft and Parts	Aircraft excl. Engines			Aircraft Engines
1939	N.A	41 8			44 1
1940	N.A	43 2			45 3
1941	N.A	45 3			46 3
1942	N A	47 0			46 7
1943	N A.	48 4			47 4
1944	N.A	47 1			46 4
1945	N A	40 7			44 5
1947	N.A.	40 8			41 2
		Airc.	Airc. Props and Parts	Other Airc. Parts & Equipt. (ex. eng.)	Airc. Engines and Parts
1947	39 6	38 7	41 0	40 1	39 9
1948	41 0	41 1	39 7	41 0	40 0
1949	40 6	40 8	41 0	40 0	40 7
1950	01 0	41 4	42 4	41 7	43 1
1951*	43 7	43 4	41 4	43 6	46 5

* Estimated.

SOURCES CAA Statistical Handbook Bureau of Labor Statistics. Table by Rudolf Modley

in the purchasing power of the dollar It is due to a much larger extent to the complexity and length of the aircraft production process

▶ **No Sale**—Let us take an example to illustrate this point A company gets an order for 100 heavy bombers, it begins work on them immediately Let us say that it delivers no planes in the first year, 10 in the second year, 80 in the third year, and the final 10 in the fourth year after the order placed

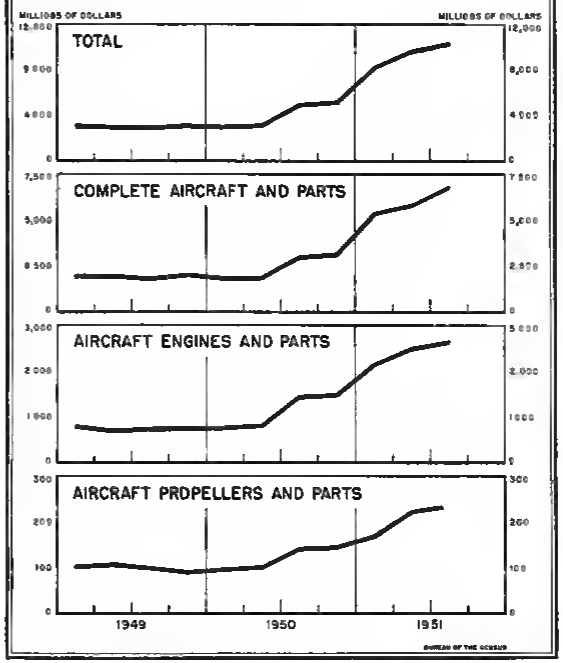
When were the planes sold? One could say that they were "sold" at the time the order was placed—that is in the first year But often the definite contract is signed six months after the order is placed, or even later In the meantime, the manufacturer operates on a "Letter of Intent"

Maybe we should say that the planes were "sold" when the firm contract was signed—say in the second year? But both these interpretations make little sense, the military will make only partial payments while production is in process and what sense does it make to report a "sale" when most of the work hasn't been done, when the final amount of the "sale" is subject to change orders renegotiation, redetermination, etc?

Thinking thus, a manufacturer may decide that the planes are "sold" when

(Continued on p 38 additional charts on p 37)

BACKLOG OF ORDERS 1949–1951



Employment in Airframe, Engine & Propeller Plants

Year	Airframe	Engine	Propeller	Total*
1914	N.A.	N.A.	N.A.	108
1919	N.A.	N.A.	N.A.	3 595
1921	N.A.	N.A.	N.A.	1 395
1923	N.A.	N.A.	N.A.	2 901
1925	N.A.	N.A.	N.A.	2 791
1927	N.A.	N.A.	N.A.	4 422
1929	N.A.	N.A.	N.A.	14 710
1931	N.A.	N.A.	N.A.	9 570
1933	N.A.	N.A.	N.A.	7 610
1935	N.A.	N.A.	N.A.	11 334
1937	N.A.	N.A.	N.A.	30 364
1939	N.A.	N.A.	N.A.	45 535
Jan. 1940	59 000	10 000	3 000	72 500
Jan. 1941	140 197	41 329	8 609	194 135
Jan. 1942	341 503	104 190	14 697	460 396
Jan. 1943	770 471	213 054	33 359	1 027 914
Jan. 1944	991 991	337 [illegible]	57 104	1 907 [illegible]
Jan. 1945	723 580	286 238	48 183	1 058 236
Jan. 1946	148 602	N.A.	N.A.	150 000*
Jan. 1947	169 521	33 346	N.A.	205 000*
Jan. 1948	149 062	32 263	8 126	190 151
Jan. 1949	158 800	28 340	8 247	214 500
Jan. 1950	163 145	31 901	8 377	211 423
Jan. 1951	230 155	53 108	9 000	292 821
Jan. 1952	350 000*	80 000*	11 000*	441 000*

* Estimated;
1914-1938: Average Number of Wage Earners; Engine Plants excluded; 1937-1939: Average Number of Wage Earners, Engine Plants included; 1940-1945: Prime Contractors; 1946-date: Plants reporting to Census Bureau.
Table by Rudolf Modley

Labor Turnover

(per 100 employes, 1951)

AIRCRAFT

Month	Accessions	Separations	Net Gain
Jan.	11.2	4.0	7.2
Feb.	8.1	3.6	4.6
Mar.	9.6	5.0	4.6
Apr.	7.6	4.7	2.9
May	7.7	4.8	2.9
June	15.6	4.4	9.1
July	7.6	4.1	3.7
Aug.	7.2	5.3	1.6
Sept.	7.6	5.4	2.2
Oct.	7.8	4.5	3.4
Nov.	6.7	5.6	6.6
Dec.	N.A.	N.A.	N.A.

AIRCRAFT ENGINES AND PARTS

Jan.	5.5	2.4	3.1
Feb.	6.3	2.6	3.5
Mar.	6.6	3.6	3.0
Apr.	6.7	3.1	3.5
May	7.6	3.4	4.2
June	6.3	2.6	3.4
July	7.6	3.4	4.2
Aug.	7.1	4.0	3.1
Sept.	7.2	4.6	2.6
Oct.	6.6	3.6	3.3
Nov.	6.3	3.0	3.3
Dec.	N.A.	N.A.	N.A.

N.A. Not available. *Table by Rudolf Modley*
SOURCE: Bureau of Labor Statistics.

each one is delivered. Instead of one "sale" in the first—or second—year, he will thus report 10 sales in the second, 80 in the third, and 10 in the fourth year.

Actually, many companies don't follow any one of these alternatives, but use a method which reports a "sale" only when an entire contract has been completed, in our case this would be in in the fourth year.

The above is only an illustration; the actual situation is very much more complex.

▶ **Compromise**—The Census Bureau, which interprets an aircraft sale as "that portion of orders that have passed through the sales account," rightly despairs of any chance of measuring the value of aircraft "sold" during one year. All it measures in the monthly Plant Reports is the number and value of civil aircraft shipments made during the month, regardless of when all or part of the production process took place or when these planes were "sold."

In the Census of Manufacturers it measures the value added by manufacture during the year without tying it to the shipments made during the year or to the "sales."

Thus it may be possible for one plant with thousands of workers to "sell" nothing in a whole year—when no shipments are made which this plant classifies as sales—and it is also possible for a plant that was idle for most of a year to have enormous "sales"—if the last item of a large production order

Average Airframe Weight

Military Aircraft

1940	3 800 lb.
1941	4 000 lb.
1942	5 500 lb.
1943	7 500 lb.
1944	10 500 lb.
1945	11 000 lb.
1946	7 100 lb.
1947	5 800 lb.
1948	11 000 lb.*
1949	12 000 lb.*
1950	12 300 lb.*
1951	12 000 lb.*

* Estimated.

SOURCE: *Aviation Facts and Figures, Census Reports.*

Table by Rudolf Modley.

was delivered during that year and the entire order passed through the sales account at that time.

▶ **Other Factors**—For those who haven't been able to follow the intricacies of all these processes, it is sufficient to say that sales figures have little meaning in the aircraft industry—except for those who know a lot of other factors that really give them meaning. These other factors are total backlog, percentage of completion of orders, deliveries, accounting procedures in use by the plant, etc.

As an aggregate of all plants, "sales" figures do, to a large extent, indicate a trend.

As a final warning, let us add that "sales" as reported by the industry and "expenditures" for procurement of aircraft as reported by the military and the Federal Budget do not need to have any relation with each other. This strange phenomenon is due to the fact that "expenditures" by the military may be for partial payments which do not appear as "sales" in the industry's books.

Floor Space

While "numbers" and "airframe weight" produced and "sales" are indicators of actual production, floor space to a large extent is an indicator of capacity to produce.

At the peak of World War II, for instance, the overall production per square foot per year was about 9 lb. of airframe weight.

This would mean that today's floor space might potentially support an aircraft production of 720 million lb. We almost certainly produced less than 60 million in 1951.

▶ **No Assumption**—It would be a mistake to assume that the availability of so much floor space is an indication that we have enough floor space of the right kind and that this floor space would make it possible to go into full time war production overnight if necessary.

Floor space is important, but ma-

Civil Aircraft Exports

(6,000 lb. and under...empty airframe weight)

Country	Units	Value
Argentina	19	$146,622
Belgian Congo	2	15,276
Belgium	2	16,098
Brazil	130	801,852
British Honduras	1	4,562
British W. Africa	1	5,434
Canada	68	530,324
Canary Islands	1	5,428
Chile	18	140,716
Colombia	28	122,521
Costa Rica	2	10,809
Cuba	5	34,016
Ecuador	8	62,785
El Salvador	2	6,573
France	6	40,135
French Indochina	3	26,336
Guatemala	11	56,429
India	6	28,471
Israel	4	19,536
Italy	1	2,578
Liberia	1	4,578
Madagascar	6	24,389
Mexico	41	226,720
Morocco	1	11,294
Panama	1	5,434
Paraguay	3	51,261
Philippines	6	38,524
Portugal & Colonies	7	331,498
Spain	2	24,713
Sweden	2	8,735
Switzerland	7	53,691
Union of S. Africa	10	82,116
Uruguay	31	124,488
Venezuela	5	26,535
TOTAL EXPORTS	433	$3,103,888
Alaska	6	32,496
Puerto Rico	10	50,082
U. S. Territorial Shipments	16	82,868

NOTE: Companies include Aeronca, Beech, Cessna Ercoupe, Luscombe, Piper, Ryan, Taylorcraft.

SOURCE: Aircraft Industries Assn.

chine tools, properly skilled personnel and material are more important. In an emergency, we shall be fortunate to have as much plant capacity as we have, it will save some valuable time. But it is only one of the many factors that have to be brought together to permit peak production.

Employment

The employment figures used in this issue are in the process of revision. The entrance of new prime contractors into aircraft production is not fully represented in these figures and during 1952 a single, more complete series of figures published by the Bureau of Labor Statistics should replace the two series presently published.

In the peak year of World War II, airframe weight produced per worker (adjusted for subcontracting) exceeded 1,000 lb. During 1951, even if we do not make any deductions for subcontracting, the output was undoubtedly below 200 lb.

When floor space now being readied is brought into use and machines, materials and components for quantity production become available, output

Consumption of Selected Materials

(per pound of airframe weight produced)

Mill Shapes and Castings	1939 (lb.)	1946 (lb.)	1947 (lb.)
Carbon Steel	3.4	2.6	1.6
Alloy and Stainless Steel	2.5	2.3	1.8
Aluminum	2.9	2.2	2.3
Copper and Copper Base Alloy	14	N.A.	94

NOTES: The poundages shown include materials used in airframes, engines, propellers, and their parts.

These figures are based on the assumption that the materials purchased during the year are used in the same year's production.

Consumption per pound of airframe weight in 1947 is lower probably because military airframe weight produced in that year represented only 46% of that year's production while it represented 69% in 1946 and 92% in 1950.

SOURCES: *Bureau of the Census, Series MAS-60-7 Jan. 7 1952; AVIATION WEEK Table by Rudolf Modley.*

Aircraft Industry Consumption of Selected Materials

Year	MILL SHAPES & CASTINGS: Alloy and Stainless Steel — Short tons	Alloy and Stainless Steel — % of round fabricat'g industry Total	Aluminum — Short tons	Aluminum — % of metal fabricat'g industry Total
1947	24,017	6	33,838	7.4
1948	41,464	7.5	40,001	6.2
1950	83,710	7.4	60,000	9.5

SOURCE: *Bureau of the Census, Series MAS-60-7 Jan. 7 1952. Table by Rudolf Modley.*

per worker should go up quickly. It is difficult to forecast just when, in 1952, this upward swing will start.

Increase in employment has been continuous during 1951 but at a decreasing rate. This writer is doubtful if, even after further increase and revision of employment reporting, the total employment of all prime contractors will exceed 750,000 by the end of 1952.

The Links

The quick analysis given above should be enough of a warning to make any armchair production expert approach aircraft production forecasting with much trepidation.

As a final warning, it should be remembered that in spite of all ratios and past experiences described in here, effective output of military aircraft will

Personal Aircraft Shipments—1951

Manufacturer	Complete Aircraft	Net Billing Price (000)
Beech		
Bonanza	977	
Twin Bonanza	4	$7,708
D-18	48	
Cessna		
140A	35	
170A	416	3 573
190	35	
195	69	
Luscombe		
8C-1B	14[1]	132[1]
8F	28	
Mooney—M-18	36	49
Piper		
Family Cruiser	1	
Tandem Trainer	490	3 333
Pacer	900	
Clipper	1	
Taylorcraft	14	37
TOTAL	2 302[2]	$15 887

[1] Includes 7 GC-1Bs valued at $27 000 shipped by Texas Engineering.

[2] Includes shipments by (1) Aeronca of 12 Champions, 20 Sedans and 2 7CCMs valued at $101 000 (3) Ballanca of 11 Cruisemasters valued at $166,000 (2) Call Air of 3 Call Aire valued at $12,000. (4) Engineering & Research of 7 Model Gs valued at $24,000 (5) Ryan of 104 Navions valued at $1 216,000.

SOURCE *Aircraft Industries Assn.*

Propellers Produced

Year	Military	Civil	Total	Value Mill $
1940	14 290			25[1]
1941	36 128			93
1942	196 130		196 130	101
1943	213 937		213 937	341
1944	243 141		243 741	401
1945	90 496	2 000[1]	85 500[1]	210[1]
1946	946	N A	N A	N A
1947	2 526	41 113	43 651	N A
1948	37 843	23 004	60 847	81 9
1949	45 111	11 343	57 113	87 6
1950	N A.	10 412	N A.	84 2
1951	N A.	16 000[1]	N A.	100 0[1]

[1] Estimated. [2] Includes value of parts.

SOURCES *Statistical Handbook of Civil Aviation, 1950; Aviation Facts and Figures; Census Reports; Table by Rudolf Modley*

only be as high as the output of the weakest link in an incredibly complex chain of links. All the floor space, plus all the machine tools, plus all the workers, plus all the material will not help us fight a war if one single essential component is lacking.

And if the experience of 1951 is worth anything, it should serve as a sound warning that the number of weak links was large enough to confound all the schedules which were gotten up by the experts.

U. S. Research and Development

(Millions of Dollars)

Year	Total	WHO DOES IT			WHO PAYS FOR IT		
		Government Labs.	Industry Labs.	University Labs.	Government	Industry	University
1941	600	200	390	90	380	510	50
1942	930	280	560	90	330	680	90
1943	1,000	300	650	100	630	800	70
1944	1,200	330	760	110	770	410	90
1945	1,400	430	850	120	880	410	110
1946	1,800	470	1,200	130	950	800	50
1947	1,810	530	1,150	130	750	990	70
1948	2,080	570	1,390	200	920	1,030	130
1949	2,040	550	1,310	220	1,550	830	110
1950	2,240	570	1,430	240	1,980	1,080	180
1951	2,500	700	1,630	260	1,810	1,170	120
1952	2,930	830	1,820	280	1,940	1,190	100
1953	3,340	900	2,030	320	1,800	1,250	190

[1] Outlined in President's budget.

SOURCE Resources Division, Research and Development Board

Growth of Research Feeds Industry

- Government supplies the money, industry supplies the manpower. But neither is unlimited.
- Further expansion may be slowed by shortage of scientists and engineers, and by inflation.

By Kenneth S. Colmen and Robert Zalkin*

Our standard of living in time of peace and our national security in time of war depend in large measure upon the nation's progress in scientific research and development.

Through research, new facts, techniques and physical laws are uncovered. Through development, these are applied to the creation of new or improved materials or methods.

As in many other fields which contribute vitally to the civilian economy the growth of research and development has occurred largely as a result of war and the threat of war.

World War II was the first war in history to be affected decisively by weapons unknown at the outbreak of hostilities. This fact provided the impetus which has lifted research and development from the role of an important but rather obscure activity to that of a vigorous and expanding industry. The present emergency has again increased the level of research and development to a new peak.

▶ **The Growth**—Research expenditures (development will be included as a part of "research" hereafter) are a small but increasing portion of the total national income. They now comprise almost 1% of the total. The actual amount spent on research more than doubled in the decade of the 1930's and tripled again in the following decade.

It may be conservatively estimated that the nation's research expenditure will total $3 billion in 1952, of which about one-sixth will be spent in the field of aircraft. This means that more than $20 will be spent for each person in the United States on research and development.

Much of this expansion in research expenditures, however, reflects the decreasing value of the dollar. A truer measure of the growth of research is scientific manpower. When the number of engineers and scientists engaged in research and development is examined, it is noted that while growth has been continuous and fairly rapid in the last decade, personnel expansion has been only half as rapid as the increase in expenditures. This disparity is particularly evident in the period 1945-1947, when the large increase in expenditures was due almost entirely to inflationary pressures.

▶ **The Manpower**—One-fifth to one-fourth of the nation's engineers and scientists are engaged in research. At the present time, for example, about 40% of the 185,000 scientists and 15% of the 415,000 engineers in the nation are working in research. There is a trend, however, toward increased use of engineers in research work.

About 60% of the nation's research engineers and research scientists are employed by industrial organizations, about 20% by universities. More than 15,000 engineers and scientists are engaged on aviation research and development, and most of them in industry.

While industrial organizations have increased their research staffs steadily for the past two decades, the major expansion in government research staffs has occurred during wartime, and university research staffs have increased primarily in times of peace. Future expansion of the nation's research population may be seriously affected by the increasingly severe shortage of engineers and scientists.

▶ **The Money**—While industries and universities employ more than three-fourths of the nation's research engineers and research scientists, the federal government is one of the major providers of research funds. Prior to World War II, the federal government expressed relatively little interest in research, and industry financed the bulk of the nation's program. By the peak of the war, however, almost 70% of the country's research funds were provided by federal agencies.

Federal expenditures declined in the

*Resources division, Research and Development Board.

U. S. Research Engineers And Scientists*

Year	Personnel (000)			
	Industry	Government	University	Total
1941	44	14	14	73
1942	44	14	15	73
1943	48	20	15	83
1944	54	25	14	94
1945	54	27	19	100
1946	57	27	19	103
1947	60	25	30	109
1948	64	25	22	111
1949	67	25	25	117
1950	71	25	27	123
1951	74	24	27	125
1952	77	21	27	125

*These figures differ somewhat from those presented in the 1947 Report of the President's Scientific Research Boards (Steelman Report). The Steelman data included all Federal Government employes classified as physical, biological or agricultural scientists, and all equivalent full-time faculty members of colleges and universities. This table includes only engineers and scientists actually engaged in research and development.

SOURCES

1. Industrial Research Laboratories of the United States (National Research Council 1940, 1946, 1950)
2. Survey of Civilian Research and Development Engineers and Scientists of the Department of Defense for FY 1950 (Research and Development Board, 1950)
3. Budget and personnel data for other government agencies.
4. University Research Potential (Engineering College Research Council 1950)
5. Manpower for Research (Vol IV of Science and Public Policy. The President's Scientific Research Board, 1947)

immediate postwar period. But industrial organizations, anxious to meet postwar competition, expanded their own programs so that total activity reached a new peak. In 1946 and 1947, more than half of the national program was financed by private industry.

Federal expenditures again mushroomed after the invasion of South Korea. At the present time, more than half of the research engineers and research scientists in the nation are being paid directly and indirectly by various departments of the federal government.

Industrial organizations carry an important portion of the federal government research programs. Most of this contract work is performed for the Department of Defense and the Atomic Energy Commission in the fields of aircraft, electronics and chemistry. About one half of the Department of Defense program is for research and development in aircraft and guided missiles. Of the ten largest research and development contractors of the Department of Defense in fiscal 1950, eight were aircraft firms.

Because of the size of the defense research program, it is in these three fields that the shortage of engineers and scientists is likely to be felt most severely. Since 1949, approximately one half of the federal program has been performed in government laboratories.

▶ **Basic Research**—Colleges and universities perform most of the nation's basic research. Prior to World War II, this program was largely supported by the universities themselves, and to a smaller degree by industry and by foundations. However, since World War II, the federal government has supported a large portion of the university program.

In 1952, for example, the Department of Defense alone will spend more than $60 million for basic research, almost all of which will be performed at colleges and universities. Since the Department of Defense now supports more than two-fifths of the nation's research and development effort, it is of interest to note that a policy statement of the Research and Development Board provides that at least 6% of the average of Department of Defense budgets for the previous five years must be spent annually for the purpose of basic research.

Although the estimates of the magnitude of research expenditures are higher than those currently available, they are nonetheless conservative, because of the difficulty of uncovering research and development programs that are included as integral portions of production programs and other activities.

Push-Button Era Is Approaching

• And new concepts for use of guided missiles for all the services have resulted in many designs and sizes.

• But secrecy surrounds progress now; later a new military service will be needed for best utilization of weapons.

By David A. Anderton

Far more than just another artillery piece, or another bomber, the guided missile is at once a new weapon—and a new concept in warfare.

In its planning and building—even at this stage more complex than those required by the atomic bomb—the missile promises new engines of war which no longer are hampered by human frailty.

From these first faltering steps towards push button warfare will come deadly assault weapons tomorrow.

The Past

There always have been guided missiles of sorts. The first was a rock, chosen because it was about the right size and weight, hurled in the general direction of an enemy with intent to kill. The rock had the proper shape to do the job, its impact was lethal, it employed initial guidance and it was expendable.

Through the centuries since then, the job of the weapons man has been to develop that rock and to endow it with a low level of intelligence so that it will seek and pursue its enemy.

Now we have just about reached the stage where we can build a low-order automaton with a one-track mind and condition it to hunt, intercept and kill.

The greatest argument for such a mechanism is based largely on emotional appeal. The missile replaces a certain number of men whose lives would otherwise be in jeopardy.

But the conduct of warfare is not properly concerned with emotions. Objectively a guided missile should be used where it can do the best job for the least cost. In other words, it should have a high overall efficiency, if you think of efficiency simply as what you get out compared to what you have to put in.

We have considered the jobs of the guided missile before. Current designs in the United States—and probably in all countries with any missile programs—fall into three general weapons categories:

• **Long-range bombardment**, which is the classic employment of the missile and the one which immediately comes to mind. From inception to target destruction, long-distance missile offensives can cost from one-tenth to one-quarter the amount of the equivalent bomber offensive.

• **Anti-aircraft interception**, which may be the most important current application of the guided missile. Ever since there have been aircraft, there have been anti-aircraft weapons—the specialized artillery piece and the specialized air plane.

During the intervening years these two weapons have been approaching a compromise aircraft killer. Visual aiming of artillery has been replaced by complicated direction-finding equipment and radar gun laying, the aircraft has been increasingly a piloted projectile, partly guided from ground intelligence. The guided missile is at once the compromise and the ultimate weapon.

• **Aircraft armament**, which may solve the problem of jet-to-jet combat. The air-to-air missile can be carried aloft on fighters and directed against the toughest hide the enemy can use to sheath his bombers. Homing devices independent of pilot skill, a blast warhead and proximity fuse point toward a high kill probability. And the total weight of launchers plus a handful of missiles would be less than the necessary cannon, shells and equipment to guarantee the same number of kills.

In these three categories, the United States is gathering strength.

But it took a long time, and an industry depression before this came about.

▶ **Postwar Progress**—In the golden days of the 1946 boom in aircraft, the missile act was the one that everybody wanted to get in. And get in they did—all the aircraft companies, the accessory people, the universities, the automotive people with aircraft tools and skilled labor on hand—everybody got some kind of a missile contract.

Dozens of design studies were carried out on paper, these were all duly reported in multicolored brochures, animated cartoons, working models and color movies.

And in spite of all this frivolity, much good came out of this mad pro-

gram It pointed up many wrong answers, it underscored many right ones And it created a pool of technical manpower which had some experience on just about every kind of missile

One of the best things that ever happened in our missile program was this magnificent confusion of no Master Plan

And then came the great aviation depression of 1947 Money was harder and harder to get, missiles take lots of money So projects fell by the wayside One by one the fancy brochures turned into mimeographed final reports, closeouts of engineering results and data

And this was another good thing, because it forced the services to stop grabbing and to formulate a Master Plan, integrated into the needs of the United States as a whole, and coordinated between the services

▶ **Division of Labor**—Without much grousing—and incidentally without setting the question whether long-range bombardment was the job of artillery (therefore Army or Navy Ordnance) or aircraft (therefore Air Force or Naval air)—the services took and gave to the eventual compromise

Coordinating groups, working groups and panels were formed with all services and civilian agencies represented The Guided Missiles Committee of the Research and Development Board worked long hours, cutting and pruning—sometimes gently, sometimes with an ax—and the missile family tree began to take shape

The Present

So now it's 1952, and we've got an inventory to take And these are some of the models we'll be stocking this season

• **Terrier, for anti-aircraft defense.** This is one of the Bumblebee series of ship based guided missiles developed by the Applied Physics Laboratory, Johns Hopkins University and associated contractors for Navy's BuOrd Soon to go into large scale production at Convair's new Pomona, Calif plant, Terrier is slated for fleet use during the next few years

• **Sparrow, for aircraft armament.** This is a tiny air-to-air missile under the aegis of Sperry Gyroscope Corp and sponsored by the Navy's BuAer Production of this missile is to be handled by Sperry's new plant at Bristol, Tenn Sparrow is intended for fighter use against bombers, not against other missiles Douglas Aircraft also is building the Sparrow under subcontract

• **Nike, for anti-aircraft defense** Sponsored by U S Army Ordnance, this is a joint development program by Bell Telephone Laboratories (avionic gear) and Douglas Aircraft Corp. (airframe and aerodynamics). Nike has a solid propellant booster and a liquid-fuel rocket sustainer

These three were the first missiles to be scheduled into production after the appointment of K T Keller as director of the Office of Guided Missiles

But there are more than these three items for open stock in the coming seasons In other mission categories, we have

• **Matador, for medium-range bombardment.** This has been designed and built by the Glenn L Martin Co for the Air Force (Incidentally the AF insists on calling this a bomber and giving it the designation of B-61, thus the AF officially has no guided missiles) Depending on the worth of the guidance system—about which very little has been said and there have been no claims for phenomenal accuracy—Matador could be an operational missile in a brief period of time following the current shakedown service tests

• **Snark, for long-range bombardment.** Designed and built by Northrop Aircraft, Inc for the AF, Snark is a tailless sweptwing turbojet aircraft AF recently forced an eleventh hour cancellation of a report on Snark, which was to have been presented by four Northrop engineers at the recent annual Society of Automotive Engineers meeting

This could be a tipoff on Snark's importance.

• **Hermes, for short-range bombardment.** Hermes is an Army Ordnance project with the General Electric Co. as prime contractor. The project has broad objectives which included V-2 firings as well as basic research on rocket powerplants and fuels. Prospective outcome: A series of artillery-type missiles in the short- to medium-range category.

• **Loki, for anti-aircraft defense.** This also is an Army Ordnance contract with Bendix. Loki, reported to be a barrage-type of weapon (medium accuracy, low cost, high rate of fire), will be produced at a new Indiana site by Bendix.

• **Rascal, for aircraft armament.** Supersonic and rocket-propelled, Rascal is one of Bell's two missiles (Shrike is the other) under AF sponsorship. Bell has been quite reluctant to talk about its missile program, but evidence of its importance may be read between the lines of the helicopter division move to Ft. Worth to provide much needed factory space at Buffalo.

• **Lark, for anti-aircraft defense.** This early venture by Fairchild Guided Missile Div. is the progenitor of a line of development for the Navy's BuOrd. Only subsonic, the Lark is now a training and test vehicle for Navy and Army. But its basic guidance system—which becomes increasingly accurate as the missile nears the target—has been developed to a high degree, and will be carried through into newer weapons from Fairchild.

This about completes the roll-call of missiles which have been publicly acknowledged to exist. Certainly there are others—and some of the obsolete and obsolescent missiles have not been listed.

There are numbers of research vehicles, the V-2, Viking, Aerobee, WAC Corporal and Bumper are some of the examples.

There are target missiles for anti-aircraft missile and gunnery practice, these include Plover, Gorgon and others.

The Future

So far, we have considered the more conventional tasks of the guided missile in which it does much the same job as some other engine of war. The missile does it better, which is why we select it.

But what could the missile do that other weapons can not? Or what unique functions can a guided missile perform that now have to be handled by several units?

One task. The anti-submarine offensive. You know the complicated task force which is needed to hunt down and kill a sub. At times it involves

ships, aircraft, blimps, radar, sonar and depth charges. And these units all have faults.

Radar location is good only for surfaced subs, and snorkel licks that right away. Sonar needs sound to locate a sub, but a pressure-hulled sub lying on the bottom, or sneaking through the water with a Walther engine quietly hissing, may not make much noise.

Blimps are cumbersome, although in World War II, only one was shot down by a sub which decided to surface and fight it out, the story can be different in World War III. And once you've located the enemy, today's depth charges don't even fall through the water fast enough. The shape is all wrong.

▶ **Missile Force**—But here's a carrier task force of tomorrow, steaming under an air cover of scout missiles. A handful of them are always in the air, flying a woven pattern over the force and the water around it. They are catapulted off and landed on by a development of the Navy's almost ready automatic carrier approach and landing system.

By various detection means these scouts can see a submarine far off, through clouds, air and water. And when a sub is spotted, the belly of the scout opens to spawn another smaller winged missile, great-grandson of a depth charge and a glide bomb. It drops away and silently nears the water.

Then there is a sudden roar as a proximity fuse ignites its rocket motor. The missile drives into the sea, its wings shear off and the body plunges deep, thrust on by the rocket motor. Into the sub's hull it dashes—and explodes.

But this isn't particularly fantastic. The elements of such a system exist today; and some of them have been in existence for seven years now. We need to put all the pieces together. Such a system would be leagues ahead of today's team.

▶ **Another Job**—The guided missile can be used to cause destruction on a grand scale that Genghis Khan might have envied. The atomic bomb is thorough, but it doesn't destroy completely a modern steel and concrete factory at a reasonable distance from ground zero tests have shown.

Neither do incendiaries. Neither do high explosives. They'll knock down a wall, or drop the steel roof trusses in a twisted mess over the machinery, but in a few weeks the factory is back in production again.

In attacking heavy buildings, let's think about the Navy's ideas about sinking battleships. The way to sink the dreadnought, says the Navy, is to let water into her. Thus, torpedoes are more effective than shelling of the superstructure.

With buildings, the thing to ruin is

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the foundation. Too often that can survive the more conventional forms of attack. But if the deep strata which support that foundation were torn and shaken and split, then the building itself could not survive. And that we can do with a special missile.

What we want is a beast which can drill a very deep hole before it blasts into fragments.

▶Airborne Mole—And here it is, a tall missile, launched from an emplacement behind the lines, flashing silvery against the deep blue of the stratosphere. Coasting through the zenith, it falls taildown toward earth. And then its tail feels the solid air and weather vanes the pointed nose down, aiming at a huge sprawling industrial combine.

Speed builds up. Skin friction begins to heat the nose, the fin leading edges. A timer kicks in the rocket motor again, and gathering speed, the fin mole hurtles toward the ground.

It smashes through sod and sand, gravel and gneiss, it pierces deep into the earth. Its shell is incandescent and deforming.

And then with a shuddering roar, the surface above heaves, writhes, blasts upwards and subsides. Where there was a factory is rubble. Complete, piecemeal rubble. Rubble the size of your fist.

And this isn't particularly fantastic, either.

The missile to do this job would be a very advanced version of a basically simple ground-to-ground weapon like the V-2. Of course, every basic component would have to be extrapolated to a much higher degree of accuracy and reliability.

But this task and the anti-submarine job are ones that call for the development of special missiles. Today's efforts, while amazing in places, still are based on conventional thinking. They represent the pilotless aircraft, the manned artillery projectile—not the guided missile which is a separate identity.

A New Philosophy

That's today's inventory, with a quick forecast of tomorrow's. That's only one small part of the story behind guided missiles.

They start off by being an adjunct to conventional offensive and defensive weapons. They are fighter armament, glide bombs, Azon, Razon and Tarzon.

They then take on new tasks, or perform the old ones at new high levels of efficiency. They are the German V-1 and V-2, Bat, Lark, Nike.

Following this early phase is a transition period. The older weapons of war are gradually replaced with these new engines. We spend time and money and missiles training the men who will fire them. Basic research and development programs are accelerated.

Then we supplant the first anti-aircraft battery, then more and then all. The experimental model of the last of our big bombers flies at the same time that the first long-range missile blasts off its firing table. The Navy converts dozens of its surface craft to guided-missile carriers.

Now, we are in this transition period. We are beginning to learn how and where missiles replace the usual weapons of war.

And we see missiles becoming air power in ten or fifteen years. We see Matador and Snark and a host of unnamed craft.

▶When It's Air Power—That point—where the missile becomes air power—is, to many, the end.

What they have failed to see is that the missile can become a powerful naval weapon and an equally strong land weapon. These new moronic engines of death contain within their monsters' loins the seeds of new generations of war machines.

And this is a powerful argument for a new service—not exclusively air or land or sea—which can free the missile from the philosophy of the battleship admiral, the bomber general and the infantry general.

GROWTH OF AVIONICS is shown by AF and Defense Secretaries Finletter and Lovett: $8,000 Norden bombsight on table, $250,000 new K-1 partly visible at right

Avionics' New Role in Air Power

• With airplane and engine design and performance becoming equal among nations, superior avionics may give air superiority.

• But, in the same way, avionics can lose air superiority if the problems of reliability and maintenance are not whipped.

By Philip J. Klass

Our ability to maintain air supremacy may be determined by a few boxes of vacuum tubes, resistors, and capacitors. The important contribution which avionics equipment can make in modern warfare is one of the lessons being learned in Korea. But another equally important lesson is that we must solve the avionics reliability and maintenance problems.

Certainly outnumbered, and possibly outperformed and out-gunned by the MIG-15, the F-86 should be on the short end of the score. But it isn't. General Vandenberg has attributed this accomplishment to superior pilot training and techniques, and to superior computing gunsights. Behind the phrase "superior computing gunsights" is a significant avionics contribution.

I. The Test of Combat

The automatic computing gunsight, itself a complex avionics device, takes the guess work out of airborne gunnery. But it's not completely automatic. The pilot must maneuver his plane to keep the target continuously centered in his gunsight. This feeds target rate-of-movement data to the computer.

The computer must also obtain information on the target's range. And this data is critically important. An error of say 20% in target range data means roughly a 20% gunsight aiming error.

▶ **Ranging Problem**—Until recently, the gunsight computer obtained this information from a stadiametric range finder operated manually by the pilot. The pilot turned a small knob on his throttle to vary the size of the gun sight aiming circle, trying to keep the target's wings continuously spanned. It was one more task for an already overburdened pilot in combat.

▶ **Avionics Assist**—Here was a likely spot for some avionics assistance. And the F-86 and F-84 got such an assist in the form of a small airborne radar. Originally developed by General Electric for the Navy, the radar continuously and accurately determines the range of the target.

This range data is automatically fed to the gunsight computer. Not only does the accuracy of the computer output go up as a result, but the pilot is freed from the task of manual ranging. This permits him to concentrate on tracking his target and keeping it centered in his gunsight. This in turn provides more accurate computer data on target rate, further improving the kill probability.

▶ **Airframe Stalemate?**—Our current production build up should eventually allow us to meet the enemy in at least nearly equal numbers. But some of the experts feel that it will be a nip and tuck race to gain any appreciable advantage over the enemy in engine or airframe design. And recent reports from Korea indicate that our present advantage in superior pilot training and techniques may prove a fleeting one.

That is why more and more hard headed military men are looking to new automatic avionics equipment to provide the thin margin of air superiority. And that explains why so large a part of our military budget is being spent in avionics research and development, which will in turn be reflected later in even larger production orders for avionic equipment.

▶ **The Hooker**—But avionics equipment also can lose air superiority for us. The growing number of avionic "black boxes" increase the plane's gross weight, reducing performance. In addition, more generators and inverters (and associated controls) must be added to provide electric power for the avionics gear. And more fuel is required to drive the added generation equipment, ad infinitum.

So the price of avionics gear comes out of airplane performance, if the equipment breaks down or can't be kept operational.

As avionics equipment becomes more useful, it becomes more complicated and subject to failure. That's what prompts thoughtful military and technical personnel to ask:

• How can we increase the reliability of avionics equipment?

• When it does break down, will it take a Ph.D. to find out what's wrong?

• When we find out what's wrong, how quickly and easily can we fix it?

II. The Tactical Need

Granted that a little avionics equipment is a good thing, maybe too much will kill us. How can the swing to automaticity be justified? This is one question whose answer finds the Navy and Air Force in complete agreement.

Marine Col. E. C. Best, Deputy Chief of BuAer's Electronics Div., put it this way: "The limited response of

the human being in the face of faster requirements for high-speed jets, makes automatic controls mandatory".

▶**In Strategic Bombing**—The destructive power of a single one of our bombers carrying an A bomb has gone up by a factor of 1,000 or perhaps 10,000. Getting a single bomber through to hit the target is therefore many times more important than in World War II. And getting a single multi million manhour bomber back for future strikes is also important.

Not only must the strategic bomber navigate over longer distances but it must do so with improved accuracy.

Not only must it contend with radar-directed anti-aircraft (so deadly in enemy hands) but it will face more effective fighter opposition.

Not only must the crew withstand the fatigue of a longer mission, but they must accomplish their tasks with fewer crew members in the new jet bombers.

In the face of these conflicting requirements, the military has no choice but to turn to automatic avionic equipment for help.

▶**Navigation and Detection**—Errors in navigation and in target detection were responsible for the most serious shortcomings of our World War II strategic bombing. This is according to Col Robert Jarmon, head of the USAF Armament Division in the Pentagon.

Jarmon credits the use of avionics in the form of Loran for the improved bombing accuracy achieved in the war against Japan. (Loran is a means for determining aircraft position relative to two or more pairs of transmitting stations radiating low frequency pulse signals.)

However, Loran is limited to a range of about 700 miles by day, 1,400 by night, and presumably requires transmitting stations located within that range of the target.

Another approach to navigation and target detection is to use airborne radar for continuous observation of terrain in the flight path. The recently announced K-1 bombing system weighing some 2,000 pounds utilizes radar sighting. However, this approach is subject to enemy jamming and it provides useful intelligence to an enemy on bomber location.

▶**Ideal Solution?**—The best type of navigational device for a bomber might be an airborne equipment which did not need to obtain its intelligence from ground installations, and which provided no radar illumination of the bomber. This suggests the use of inertial (gyroscopic) guidance or celestial navigation devices. Such devices may be presumed to be under development for long-range guided missiles and they will undoubtedly spill over into bomber useage.

The inertial guidance system will possibly consist of very low drift gyros monitored by other devices through servo systems to correct for even the gyros relatively low drift. The celestial navigator might consist of a device which is servoed to track automatically two or more stars simultaneously and continuously. With the aid of a computer, the star tracker could then establish bomber position in space with extreme accuracy.

▶**Bomber Defense**—Another Korean lesson is that B-29's and their World War II remotely-controlled computing turrets are no match for the MIG-15.

If speeds of Mach .98 (currently estimated as necessary for bomber defense) are to be obtained, it probably means that external gun turrets must go.

But if enemy fighter speeds are increased in their new designs, even a Mach .98 bomber may find itself relatively defenseless without some armament. A compromise may see a bomber tail turret installation equipped with heavier ordnance, eventually replaced by air-to-air missiles for the plane's defense.

The success of radar-directed anti-aircraft suggests that an airborne ap-

plication of this principle for whatever turrets are retained will be used to bolster bomber defense. And it will be equally effective for daylight or night operations.

Protecting the bomber against anti-aircraft is difficult for avionics to solve for practical reasons. Even a large bomber can't afford to carry a lot of jamming and counter-measures equipment. However work on this problem may be presumed to be in process.

There are other avionic approaches to making the bomber less vulnerable to anti-aircraft fire. One is to speed up the response of the bomber auto-pilot. This permits the bomber to spend less time on the "sitting duck" bomb run. This improvement is already going into use on the Boeing B-47B's.

▶**Ticker Tape Flight**—The Air Force is working on automatic flight programming and has a requirement for it in certain types of operations. This was confirmed by Capt. James Anast of the USAF's All Weather Flying Division at the recent Institute of the Aeronautical Sciences annual convention in New York where he delivered a paper on automatic aircraft controls.

It is not difficult to envision how such a system might operate. The entire flight plan for the mission would be coded on a punched tape. Once inserted in a play-back unit on the bomber, the tape would transmit a continuous stream of signals calling for the desired bomber ground track, ground speed, and cruising altitude.

These signals would be compared with the actual ground track, speed, and altitude as established by the inertial or celestial navigation system. Any deviations from the flight plan would result in signals being sent to the autopilot and engine controls for corrective action.

The pilot would monitor the tape-controlled flight being prepared to take over in the event of unexpected enemy counter action. It is probable that tape-controlled flight would actually result in a more efficient following of the flight plan, stretching fuel, and in effect increasing bomber range.

▶**Engine Controls**—Jet engine life will go up and troubles will come down, as avionics enters the field of jet engine controls. A leading jet engine manufacturer has found that engine troubles are reduced by 50% when the engine is operated through an avionic control system.

With the automatic engine control the pilot will merely push forward on his throttle when he wants more speed. The avionic system will adjust the rate of fuel flow to keep engine tailpipe temperature and engine speed at safe levels. With the automatic control, critically important engine fuel consumption will be greatly reduced.

RADAR RANGE SET developed by GE helps give gun gunners an edge over Reds

▶**And Still Others**—There are many other jobs for avionics in the bomber's mission. Many are old shoe. Some involve improvements in existing performance, like the problem of licking 'blind spots' in certain areas around the airplane during plane-to-plane UHF communication. Col. D. P. Graul of the USAF's Electronics Division stressed the need for an avionic means to permit bombers to rendezvous and get into formation in all weather operations. This probably means a radar beacon.

To fatigued flight crews, possibly in battle-damaged aircraft, improved automatic approach and the newly developed automatic landing couplers for autopilots will be among the welcome additions.

▶**In U. S. Air Defense**—Probably the best way to describe the problem of seeking out and destroying a 600 mph. jet A-bomber under all-weather conditions is to compare the task to finding the proverbial needle in a haystack, with one significant added proviso. If you don't find the needle within 60 seconds, the game is over. And the penalty for failure is high.

To give an interceptor the speed and rate of climb it needs to knock down a jet bomber means keeping it small and sleek. That means a single-place aircraft.

All radar scope presentations require a measure of interpretation. A multitude of data must be presented to the interceptor pilot on his scope to enable him to determine his next move. And what he sees he must quickly convert into rudder and stick motions to put his plane on the necessary flight path to bring him into firing position.

▶**Sixty Seconds**—Assume that a 650 mph. interceptor is flying toward a 600 mph. bomber for an interception. Assume also that the interceptor's airborne radar has a range of 20 miles.

In less than 60 seconds after the interceptor picks up his target on its radar the two planes will pass. But that doesn't mean that the interceptor pilot has a full minute in which to determine his intercept course and get his aircraft into position.

The success of the intercept will probably be determined by what the fighter pilot does in the next ten seconds. If he dallies too long in determining what to do, it will be too late to do it. He won't be able to pull enough G's to make the maneuver.

An interceptor's problem is really a quadruple play, in baseball terminology. It's the radar to the computer to the pilot to the airplane. The pilot is the slowest weakest member of the team. The logical solution is to replace him with an automatic pilot and to tie all the avionic equipment together in a single loop which includes the airplane. And that is just what will be done.

▶**Integrated Loop**—The interceptor's radar will then track the target, providing information on its range, and azimuth and elevation rate of movement. This information will be fed to a computer which instantly calculates what path the airplane should fly to intercept the target.

Signals from the computer will go to the autopilot which will quickly maneuver the airplane onto the desired flight path.

This doesn't mean that the inter-

ceptor pilot will be able to sit with hands folded. He will have to constantly monitor his equipment.

▶**Other Automatics**—The interceptor will be equipped with the same automatic avionic controls for its jet engine, to provide maximum thrust and fuel economy within the operating speeds and temperatures of the engine. Automatic approach couplers and automatic landing couplers will also be "musts" on the interceptor.

▶**Ground Assist**—If the relatively short range of airborne radar can in effect be extended by an assist from ground radar, the chances of successful interception are greatly increased. The surveillance radar net currently under construction can provide such an assist. The problem is to convert ground radar intelligence into immediately useable intercept information. To guide the interceptor pilot by telling him "five minutes ago the target was headed south" is hardly better than handing him last year's newspaper for guidance.

The answer to this problem will come from ground-based avionics equipment in the form of a series of regional intercept control stations equipped with variations of the highly touted "computing brains."

▶**Ground Computers**—Information on the bearing, altitude, speed, and range, and possibly concentration of the enemy aircraft will be fed to the computers from the radar net. From this information and based on the relative strategic value of targets in the area, the computer can instantly determine from which bases our interceptors should be launched and in what numbers.

Since an enemy can be expected to make diversionary feints and simultaneous attacks, the problem of quickly and continuously evaluating the tactical situation, with its many variables, dictates the use of avionic computers.

That the military services are developing such computers was confirmed by Pentagon spokesmen, although the details of its operation are a result of conjecture.

The output information obtained from the computers can be transmitted orally by radio to interceptor pilots. However, an automatic radio link between the ground computers and the airborne interceptor system will come because the tempo of events is so fast that it doesn't allow for the use of word messages to convey commands."

▶**In Ground Support**—An enemy tank or gun emplacement is a fleeting target of opportunity which must be hit immediately if ground troops are to benefit. The proximity of friendly and enemy positions makes the problem more difficult.

Korea focused attention on the

problem, and it has only recently been handed to the avionics industry. That's why there's little progress to report. Whatever the solution, the device must permit individual planes to seek their own targets of opportunity with a minimum of coaching from the ground.

One possible solution is the use of infrared, and both services are active in this field.

III. The Progress

The exact progress that has been made or is being made in some of these complex avionic equipments is not available for obvious reasons. But some of them, like the speedier autopilot response for the B-47's have been officially announced.

Others, like the automatic engine control announced by Pratt & Whitney Aircraft may be presumed to be past the development stage and currently under test. Production then might be a year off, with tactical availability perhaps in 18 months.

The new K-1 bombing system, itself a big improvement over World War II bombsights, is reported in use on medium and heavy bombers.

▶**So Long?**—It takes three to five years to develop complex avionic armament systems, according to Col. Jarmon. Another 18 to 24 months is then normally required to place them in production. In some cases, work must begin on the avionic gear for a new airplane even before the work on the airplane itself is started.

Fortunately, there are exceptions. Certain equipment discussed may come along faster than anticipated. This is possible because it is essentially an integration of existing devices or components into a more complex system.

For example, airborne radars and computers are known to be in production for current all-weather interceptors such as the F-89, F-86D, and the Navy F3D-2. Separate autopilots are used on many of these aircraft. Hence the design of an automatic interceptor system using these sub-systems is not like starting from scratch.

But on the other hand, it isn't as easy as it might appear. Each of these major interceptor system components is in itself a complex servo mechanism. Blending them into a stable smooth working system is no snap.

▶**1954 Interceptor Program**—Much has been rumored about the Air Force's 1954 interceptor program. Presumably it includes at least a completely automatic airborne system, and possibly even includes the ground-to-air link.

A Navy spokesman told AVIATION WEEK that "within the near future the Navy will have a completely automatic airborne interceptor system flying." Probably such a system will not include the ground-to-air link.

However, much prior work has taken place in the field of telemetering of data from air to ground and ground to air for missile work and radio-controlled drone applications. The ground-to-air link need not be too far off once the airborne system problem has been licked.

Interesting progress in ground-support bombing is provided in a Navy revelation that the Marines are using a BuAer developed blind-bombing system which is completely automatic.

Probably within three years many of the automatic avionic equipments described will be ready for or in production. Within five years all of them should have reached that stage. But the military won't be able to sit back and relax. Its troubles will just have begun. The twin problems of reliability and maintenance will be rising to plague them.

IV. The Major Weakness

What percentage of our new bombers will be forced to abort a mission because of failure of one critical avionic device? What percentage of our automatic interceptors will be flyable when

and if the call to action comes? These are questions which are worrying military personnel on many levels. This currently makes "reliability" and "maintenance" popular subjects for discussion.

Much of an equipment's reliability is determined in its initial design phase. But the maintenance it receives also determines its score on reliability. It is reported, for example, that a high percentage of the Navy's electrical equipment failures on shipboard are attributed to lack of means for preventative maintenance.

The B-29 central fire control system, which in its day was a very new and complex avionic equipment racked up a remarkable record of better than 95% operational over the target. This was due to good design, ably supplemented by well trained Air Force maintenance personnel equipped with adequate spares and useful test equipment.

But failure in the air is not the only aspect of the reliability problem. World War II records indicate that up to 25% of avionic equipments were found to be inoperative after only 12 months storage under optimum conditions. That kind of unreliability pyramids spare parts requirements on a heavily loaded production machine—and the military realize it.

▶**Plenty of Talk**—At the moment there appears to be more talk about, and hope for, reliability than direct progress. Emphasis seems to be largely on getting out the new "blue-sky" wonder boxes, or the vastly improved performance. "Why worry about making it reliable until we're sure we can even design it?" might be a justifiable attitude for an avionic development engineer.

But possibly this is just where the first step toward reliability should be taken. That doesn't mean burdening down the research and development engineer with problems of reliability. Rather it means establishing an entirely separate design group to convert the initial solution into a reliable piece of avionic equipment. That's the view expressed to AVIATION WEEK by Dr. A. F. Murray, consultant to the Research and Development Board's Ad Hoc Committee on Reliability of Electronic Equipment, which was established some months ago.

Dr. Murray feels that the reliability design group should have complete authority to make major circuit redesigns and component substitutions wherever necessary to improve reliability. Some avionics manufacturers are organized along such lines.

▶**Inherent Dangers**—But Dr. Murray recognizes the dangers inherent in such an arrangement. For example, a brand new development sometimes meets an urgent tactical need and is hustled in to production by the military, thereby by-passing the reliability phase.

There are indications that the military are learning that they may be better off with proven lower-performance equipment rather than leaping for new improved performance equipment which hasn't undergone an adequate period of test and design.

For example, Col. Best stated that any attempt to short circuit one or more of the many steps between development and production seldom saves time. It means the bugs must be worked out of production equipment, which is more costly and difficult.

▶**New Twist**—BuAer is trying an interesting variation to the approach suggested by Dr. Murray. A newly developed avionics equipment, designed and developed by Company "X" is being given to Company "Y" with a contract to redesign the equipment where necessary to give it a minimum life of 1,000 hours without maintenance. (Samples taken from production are given a 1,000 hour useage and must then meet the original specs.) If successful, maintenance would be eliminated before the major airframe or engine overhaul period.

▶**Better Components Needed**—Failure of avionic equipment can usually be attributed to failure of one or more components, i.e. vacuum tubes, re-

sistors, capacitors, relays, etc. Vacuum tubes usually head any gripe list of component unreliability.

But there is something to be said in defense of the component manufacturers. Military specifications for avionic equipment are extremely exacting in terms of temperature, humidity, vibration and similar requirements. And they have grown progressively "worse." The development of new and improved components often means expensive basic research into new materials and techniques. With the previously limited military procurement needs, component manufacturers couldn't justify the costly development and research.

Then too, components are often blamed when the avionics engineer is guilty. To pare size and weight, he sometimes uses components at the ragged edge of their design limits, or in applications for which the components were not designed.

The avionics engineer can point the finger right back at the military. They are constantly after him to design smaller and lighter equipment. Thus pressure is in turn placed on the military by the airframe manufacturer, and so the circle goes.

But it's really up to the military to decide whether weight and size should be sacrificed for reliability, or vice versa. Since a quantitative scale of merit for size/weight versus reliability is hard to devise, the problem is not at all easy to even define.

▶**Like the Weather**—There seems to be a feeling that little of the talk about vacuum tube unreliability is being converted into corrective action. One of the most concrete programs appears to be that originated by the USAF's Aircraft Laboratory at Wright Patterson Field. And they got into the act because the Strategic Air Command complained that tube failures were jeopardizing SAC's tactical effectiveness.

With complex avionic bombsights and fire control equipment, failure of a handful of tubes could leave a B-36 defenseless and unable to drop its bombs effectively.

Calling in interested USAF labs, and avionics industry people, the Aircraft Lab drew up a short-range program of tube improvement. The result was a spec telling, in terms of reliability and performance, just what they wanted from 6 different types of miniaturized tubes most widely used in military airborne equipment. Major tube manufacturers were called in and were told what was wanted—but not how to accomplish it. That was their problem.

▶**Different Approach**—Instead of the usual long-range study development contracts, the tube manufacturers were told to start making improvement on a piecemeal basis in their production contracts, as soon as they could. Up to

three different tube manufacturers were assigned to certain tube types, only one manufacturer to others. The original list of 6 tubes has since been expanded to 11.

General program objectives are:

- Increase uniformity between tubes of a given type, tightening up performance tolerances.
- Weed out poor lots of tubes (due to poor quality materials).
- Reduce early tube failures.

The program appears to be hitting some paydirt, based on limited test results to date. The new tubes are going into service on tactical aircraft where their performance, life, and reliability are being closely checked. But it is a continuing program of improvement, and there is reportedly room for more.

▶ **Transistors**—But by the time the tube manufacturers get the barn door locked, many of the horses may be gone. The newly developed transistors have begun to receive attention from avionic equipment designers. While transistors are at present limited in their ambient temperature operating range, they offer many advantages, not the least of which appears to be reliability. Many new avionic devices are coming out using magnetic amplifiers. Their rugged construction makes them another threat to vacuum tubes, although their use ups equipment weight slightly. Both services have high hopes for transistors and magnetic amplifiers. Both devices should also stimulate tube improvement.

Fundamental research on new materials and techniques necessary for subminiaturization is resulting in improved, smaller, higher temperature components which should improve overall equipment reliability. But the appearance of new components itself poses a problem.

▶ **The Dilemma**—Should newly developed components quickly make their way into new equipment designs? The avionics engineer must first satisfy himself that the component has satisfactory performance and life under the conditions his equipment must meet. If the new component has been produced only in developmental qualities, can it be mass produced to the same tolerances?

Answers to these questions can come only from extensive tests of the component. Meanwhile perhaps a dozen other avionics manufacturers are simultaneously testing the same new component. Or possibly one manufacturer is planning to use a new component which another manufacturer has already found to be unsatisfactory for that type of application.

Some type of clearing house for test information seems to be required. Also needed is some means of rating new components to indicate their degree of

What's doing at JACK & HEINTZ

New J & H Starter Features Positive Jaw Action

New automatic jaw-meshing mechanism replaces d-c solenoid in new model gas turbine starter. Means reduced weight and length, elimination of potential trouble source.

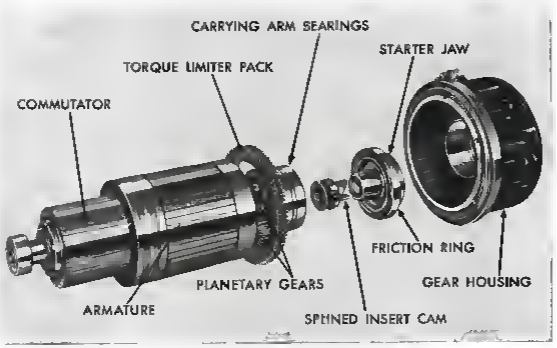
A recently developed, automatic jaw-meshing mechanism has been incorporated on a new model gas turbine starter, which is now in production at Jack & Heintz. This mechanism, a friction ring jaw-mesh arrangement designed by J&H engineers, replaces the d-c solenoid usually used for jaw-meshing action.

The new starter, designated as D31-1 by J & H, has the following advantages over similarly rated units: reduced weight, reduced over-all length, and elimination of a potential source of trouble—the d-c solenoid-type meshing action. In case of failure of solenoid or an allied component, the starter jaw will not extend, resulting in nonengagement with the engine jaw.

J & H D31-1
Jet Engine Starter

This new starter, with automatic jaw meshing mechanism, will always have positive meshing as long as there is sufficient electric power to rotate the armature. The basic action here is that of a phosphor bronze ring, which temporarily restrains jaw rotation until axial cam action extends the jaw. As the jaw moves out, the tension on the friction ring decreases until, at full extension, friction drag on the jaw is zero and jaw is driven directly by the splined portion of the planetary gear carrying-arm.

This variable voltage starter, electrically similar to our popular D26-2 model carries a rating of 135 lb-ft torque at 800 rpm, and operates on 1000-amp maximum constant current, 0-30-volt, d-c power supply. Weighing but 46 lb, it is two pounds lighter than its counterpart. Its over-all length, including end terminals, is 13 15/16 inches—1¼ inches shorter than the D26-2.



Exploded View of D31-1 Starter Illustrating Jaw Mechanism

Chief Engineer's Corner

A large portion of the Jack & Heintz aircraft business has always been in the design, development and production of aircraft engine starters. In fact, the starter was our first product in the field. From the original JH3 series through the JH6, which revolutionized the piston engine starter industry to the modern jet starter on this page, we have always designed a starter to start an engine rather than just to meet a specification. As a result, thousands of J & H starters built many years ago for military applications, are still giving satisfactory service on airline applications all over the world.

Our engineers are presently working to develop new starters for the new larger engines, and announcements about these developments will be forthcoming in the near future. You may be assured that these starters are being designed by experienced J & H engineers who are thoroughly familiar with the engines' starting requirements. If you'd like to know more about J & H starters, write JACK & HEINTZ, INC., Dept. 205, Cleveland 1, Ohio.

acceptance by the industry, and for what operating conditions.

The Research and Development Board has set up an Ad Hoc committee on Component Utilization to investigate this problem. The Aircraft Industries Assn. is supporting this program actively by having its member industries represented on the committee.

▶ **When Failure Occurs**—In spite of our best efforts toward better reliability, failures will occur. When they do, there are two problems:

- Find the trouble
- Fix it, quick.

These two phases of the maintenance problem are not only closely related in actual usage, but in the mutual design of the equipment as well.

There is a decided trend in avionic equipment design toward "unitized construction." That means designing the complete assembly as a series of plug-in type sub-assemblies. With unitized construction the fault need only be tracked down to the particular sub-assembly rather than requiring location of the specific offending resistor or capacitor. Once the fault is located it can quickly be fixed by pulling and replacing the faulty sub-assembly.

▶ **The Hope**—The Air Force and Navy are putting high hopes on the simplified trouble-shooting and maintenance which result from unitized construction. Without it, the maintenance problem looks pretty bleak.

While not too much of existing production equipment uses this technique one large manufacturer says that practically 100% of its avionics devices now in development will have unitized construction.

Sub-miniaturized construction might be considered a further extension of unitized construction. It has the added advantage of less size and weight, the added problem of heat dissipation. The trend toward sub-miniaturization doesn't seem to be as pronounced as for unitized construction using miniaturized components. However, some equipments now in development will use sub-min techniques for certain sub-assemblies. And the Navy says they will soon have production equipment with some sub-min sub-assemblies. These will be potted units designed to give 2,000 hours of trouble-free life if specifications are met.

With the current state of the art, sub-min type of construction doesn't always mean improved reliability. If forced to choose between small size/weight and reliability, Col. Jarmon indicated he would take reliability.

▶ **"Topsy" Growth**—While the trend toward unitized construction is strong, it appears to be a "topsy" sort of growth. Military specs call for reliability and ease of maintenance in general terms. However competition seems to have

stimulated the trend more than military pressures.

Since unitized construction imposes some equipment weight penalty, enunciation of a more direct all-out policy to manufacturers and designers might serve to accelerate the trend even faster.

▶ **Trouble Shooting**—If proper design attention is given to the fault isolating problem when avionics equipment is first designed, the circuitry can be routed so that important signal voltages are available at a central point. This permits the use of simplified line maintenance equipment for fault finding. Old line companies with considerable military background are more apt to understand this problem and design accordingly.

For example, the Sperry K-1 bombing system is said to incorporate "single-point-of-entry" for tester connections. But for the newcomers in the industry, and even for some of the old timers, a military sponsored educational program among avionic industry engineers might pay big dividends.

An interesting development in fault isolation will appear in some new BuAer avionics gear. A new radar set will have built-in fault-locating circuitry. A maintenance man will merely position a selector switch, and watch the fault indicator meter. If the needle falls outside a green area, the operator can tell which major assembly of the system is at fault from the position of the selector switch.

Building such devices into complex avionics gear has obvious advantages, and disadvantages. Its added weight may not be justified in airborne equipment. But the same principles could be applied to portable equipment which can be quickly connected into the avionic system when needed.

Fault isolating equipment designed for the not-too-skilled operator is a must. Both the Air Force and Navy find that the men they train so well in avionics quickly depart for better paying jobs in industry when their terms of enlistment are up.

▶ **Quo Vadis**—Soon the many new avionic devices will make our planes effective weapons for fighting a jet-atomic war. Both services recognize the resulting problems of keeping the equipment operational.

But possibly not enough of their anxiety has been converted to action. An all-out educational program to all levels of the avionics industry could focus its efforts on the problem. Enunciation of a definite policy on unitized-type construction would also help.

The maintenance and reliability problem must be solved if avionics is to provide the needed margin for air superiority and not prove a millstone around our necks.

Corporate Plane Operations Grow

- Operation and ownership of executive planes rise steadily.
- Some 9,000 aircraft flew a billion passenger miles last year.

By Nathaniel F. Silsbee*

During each of the past five years the amount of flying carried on by corporation owned and operated airplanes has shown a steady increase. This is apart from the very sharp upturn in 1947 when an estimated total of 983,000 hours was flown as compared with an estimated 534,000 hours during 1946—a gain of 84%.

Using the near million mark of 1947 as a fair postwar base the figures for 1948 were 1,288,000 hours for 1949 1,308 000 estimate for 1950 1,425,000 and for 1951 1 500 000 hours. This represents a total of some 250 million airplane miles and one billion passenger miles in 1951.

Corporation Plane Operations

Year	Hours flown	Planes owned	Multi-engine planes
1946	534 000	2 000	300 est.
1947	983 000		
1948	1 288 000	11	36*
1949	1 308 000		
1950	1 425 000		
1951	1 500 000	9 000*	1 50

*Estimated
SOURCE CAOA surveys

Corporation Multi-Engine Transports 1951

Type	Number
DC-3	275
Lodestar	160
Converted bomber types	45
Twin Beech	700
Grumman amphibians	155
Twin Beechcraft and DH Dovos	35
Lockheed 12As and Learon T-50s	100
Total	1 800

SOURCE CAOA survey

▶**Planes Up**—In 1946 there was an estimated 2 000 aircraft owned by corporations and used exclusively for business purposes, between 400 and 500 of these would have been multi-engine planes. A survey made during 1948 came up with a total of 6,741 such aircraft with about 750 of them multi-engine. This accounts for the sharp increase in company aircraft hours flown in 1947 over the 1946 figures.

Today's corporate aircraft fleet totals over 9,000, some 1,500 of these being multi-engine planes, and 7 500 single-engine four place de luxe aircraft. Probably another 7,500 single-engine planes are owned by business men and used somewhat for business purposes.

▶**Conversion Jobs**—This big postwar expansion of company flying came about when a considerable number of Air Force and Navy air transports became available to American industry through War Assets Administration.

Several hundred military transports of the DC-3 (C-47) and Lodestar (C-60) types were converted to corporation use by means of re-designed interiors, soundproofing, etc.

Companies requiring faster transportation purchased and modified a number of such wartime bombers as the Douglas B-23 and A-26, Lockheed PV-1 Ventura and North American B-25, all except the B-23 were licensed under an NL certificate by the CAA. The B-23 qualified for an NC when Pan American picked up a block of them and put one through the T-category tests, but these were later sold to private industry.

▶**New Models**—A further boost to this significant development came when Beech brought out an improved postwar Model 18—the D 18-S (or C). More than 550 of these have been produced to date (a considerable number for foreign governments), and with the converted wartime AT-11 trainers and C-45 Expediters, there are some 700 Twin Beechcrafts flying the U. S. airways in corporation service.

Among twin-engine amphibians the Grumman Widgeon has been widely used by business firms for some years. More recently some 50 of the larger,

* Exec. Sec., Corp. Aircraft Owners Assn.

more luxurious Mallards were produced, and about 35 of these are operated by American companies or business men

Thus the approximate total of 1,500 corporate multi-engine aircraft as of the end of 1951 would break down about like this DC-3s, 275, Lodestars, 160, converted bomber types, 75, Twin Beechcrafts, 700, Grumman amphibians, 155, Twin Bonanzas and de-Havilland Doves, 35, Lockheed 12As and Cessna T-50s, 100 (These are used strictly for executive transportation—there are several hundred Twin Cessnas, for example, that are used in industrial, non transport applications)

These figures are based on an early 1951 survey made by the Corporation Aircraft Owners Assn., revised by information from various sources and checked with figures prepared by the Defense Air Transportation Administration (General Aviation div.)

During the past three or four years the company aircraft fleet has been greatly augmented by several models of de luxe four place single-engine aircraft of the Bonanza, Navion and Cessna 190/195 types. The speed range and generally superior performance of these $13,000 to-$15,000 aircraft, plus their ability to utilize thousands of smaller airports generally unavailable to most multi-engine equipment, renders this class of airplane a valuable addition to U. S. air transport facilities

▶**High Utilization**—The CAOA survey indicated that companies were averaging 600 hours per year for multi-engine aircraft in 1950 with some running as high as 750 or 800 hours It is believed the average 1951 utilization will be found higher than 600 hours Single-engine aircraft totals varied widely, from 300 hours to more than 900 hours for 1950 This trend also will have been up for 1951

The 180 member companies of CAOA represent some 45 industries

The members operate close to 500 aircraft a large proportion of them multi-engine planes More than 20 oil companies operate a total of 100 of these planes Other industries represented include aircraft and engines, aviation radio, arms and ammunition, automobiles, chemical products construction & building materials electrical & electronic products farm machinery, metal products pipeline transmission, steel, utilities

Accepting the CAOA member aircraft as typical, the corporate multi-engine fleet is 98% equipped with VHF radio (including omni), and the single-engine fleet better than 90% About 30% of the multi-engine pilots have ATR ratings and over 60% have commercial plus instrument Despite a couple of recent crashes, the safety record has been exceptionally good

Lightplanes Seen Vital for Defense

Industry provides a subcontractor reserve for military manufacturers; new planes going to essential users.

By Carl F. B. Roth*

With the same aggressive determination that has marked the progress of the personal aircraft industry since its birth—and in spite of the added obstacle of scarce materials—American manufacturers of personal, executive and agricultural planes reporting to this Association in 1951 produced a total of 2,302 aircraft. This production had a dollar value of $16,887,000 figured at the manufacturers' net billing price, compared with 3,386 planes valued at $19,157,000 the previous year.

The fact that unit production was reduced almost one third, while dollar value was reduced only one-sixth, is accounted for by the fact that 1951 sales were mostly larger executive-type aircraft.

► **Defense Value**—It is significant to note that last year the Air Coordinating Committee, after very exhaustive studies of the situation, recommended that enough materials be provided to permit a production program for light utility aircraft at an annual rate of 3,500 units.

This recommended and subsequently approved level of priority support was designated as the "minimum level." It was justified by the Civil Aeronautics Administration, as the industry's Claimant Agency, on the basis of proven essentiality to the national defense and the civilian economy. Justification was supported by statistics and studies made by the report of a Task Group of the National Security Resources Board. It is interesting to note that this program also was given strong approval of the Department of Agriculture and the Federal Civil Defense Administration.

Reasonable allocations of material are now available, but there was a period of a year, following the start of the Korean conflict and the imposition shortly thereafter of priorities on materials, when the industry was denied material. This has caused the reduction in production, despite a strong market based on essential need existing in the business, industry and agriculture.

► **Industry Cooperation**—In this respect, it is worthy of note that the industry has cooperated in determining, insofar as possible, that sales of new civil aircraft produced under this program would be channeled to persons and firms who are actively engaged in defense-supporting activities and in essential civil uses.

The light airplane is rapidly proving itself to be a unique and utilitarian tool for business and agriculture. Those

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U. S. Non-Air Carrier Accidents, 1930-50

Year	Accidents		Total fatalities	Plane-miles flown	
	Total	Fatal		Per fatal accident	Per fatality
1930	2 929	500	804	360 509	214 881
1931	2 197	381	598	375 809	237 043
1932	1 830	307	516	377 675	240 546
1933	1 580	177	299	402 386	236 203
1934	1 401	184	323	419 581	234 062
1935	1 503	161	253	526 433	335 005
1936	1 674	156	281	502 087	332 549
1937	1 900	194	280	560 800	305 536
1938	1 861	178	274	734 965	472 113
1939	2 222	200	319	878 196	564 661
1940	3 471	252	358	1 137 581	735 870
1941	4 252	317	512	1 185 563	1 109 547
1942	3 324	148	220	2 053 095	1 394 342
1943	3 571	167	257	N. A.	N. A.
1944	3 343	169	257	N. A.	N. A.
1945	4 482	332	900	N. A.	N. A.
1946	7 618	500	1 009	1 598 730	568 938
1947	6 253	382	1 352	1 700 424	1 111 257
1948	7 556	350	1 334	1 728 870	1 091 806
1949	5 830	302	799	2 008 838	1 260 036
1950	4 605	426	871	N. A.	N. A.
1951	3 000	381	670	N. A.	N. A.

† Incomplete. N. A.—Not available.
SOURCES: 1930-37 CAA; 1938-50 Bureau of Safety Investigation, CAA.

who have put them to work find them indispensable. Business and agriculture activities where aircraft are put to work quickly re-adjust so that serious harm would result if the use of the aircraft were denied or seriously curtailed.

The lightplane industry has also again demonstrated that it fills a vital role in the mobilization program. Light aircraft and engine builders have the aircraft skill, know-how and the complementary facilities to take on a very important part in the field of subcontracting for major military aircraft manufacturers. Thus, this segment of the industry in both prime contracts for the military, subcontracting for others and in maintaining civil aircraft production on as high a level as possible, is more than doing its part to support America's effort to achieve leadership in the air.

Airports by Class

State	Sub I	II	III	IV	V	VI and Over	Total
Ala.	69	17	14	10	1	2	84
Ariz.	[illegible]	43	31	14	15	3	176
Ark.	54	11	1	0	0	0	84
Calif.	388	77	53	38	33	24	810
Colo.	89	36	22	1	0	0	166
Conn.	18	1	2	5	1	0	26
Del.	12	3	1	1	0	3	19
D. C.	0	0	0	1	1	1	3
Fla.	62	34	33	41	11	19	170
Ga.	63	17	31	22	2	6	112
Ida.	123	16	7	2	0	3	151
Ill.	102	43	13	9	4	0	171
Ind.	97	26	1	6	2	0	130
Iowa	137	15	5	8	0	1	166
Kan.	122	36	14	3	3	6	184
Ky.	38	3	5	4	0	1	51
La.	47	14	12	6	2	3	86
Me.	39	6	12	3	3	1	64
Md.	23	13	4	9	0	4	49
Mass.	44	11	5	7	0	5	74
Mich.	171	42	14	13	3	3	244
Minn.	79	24	5	4	1	1	112
Miss.	48	12	13	8	1	1	86
Mo.	89	17	15	5	3	0	129
Mont.	86	15	9	6	2	4	116
Neb.	102	15	5	2	3	11	134
Nev.	38	4	10	8	9	1	71
N. H.	24	4	3	2	0	1	34
N. J.	53	13	7	5	1	1	78
N. M.	48	16	7	10	7	7	95
N. Y.	180	30	13	10	5	2	246
N. C.	91	19	13	11	9	4	136
N. D.	109	13	2	4	0	3	131
Ohio	164	40	9	10	3	3	229
Okla.	91	21	13	13	7	2	147
Ore.	84	9	11	13	4	2	123
Pa.	185	34	14	7	1	0	209
R. I.	5	1	1	1	2	0	10
S. C.	60	13	3	11	0	1	84
S. D.	96	10	6	3	2	2	73
Tenn.	38	13	3	5	3	0	63
Tex.	377	105	61	46	26	14	641
Utah	29	14	13	4	0	1	60
Vt.	17	0	3	1	0	0	21
Va.	68	16	6	11	2	2	133
Wash.	110	25	11	17	4	8	175
W. Va.	41	8	2	3	1	0	55
Wis.	117	31	16	3	1	1	167
Wyo.	28	10	13	0	1	1	53
Totals	3,389	893	573	430	186	164	6,236

NOTE: Airport class is determined by length of longest runway. Sub I: under 1,800 ft.; I: 1,800-2,899 ft., II: 2,700-3,899 ft., III: 3,700-4,899 ft., IV: 4,700-5,699 ft., V: 5,700-6,599 ft., VI and over: 6,700 ft. — plus

SOURCE: CAA

Agricultural Flying Advances in 1951

Farmers throughout the country are showing an increased awareness of the utility of aviation in their field. Hand in hand with their growing interest, new advances in agricultural aviation have been unfolded.

The first plane designed from the ground up for farm work was announced by the Civil Aeronautics Administration and Texas A&M College this year. Remarkable new strides were made in crop spraying techniques, including a device to vary the swath covered by a low flying plane. Apple growers leaned more heavily on hormone applications by helicopter to keep fruit on trees longer. Elsewhere there were marked improvements in frost, brush, insect and weed control—using air power.

CAA listed 8,000 airplanes doing chores connected with land management. In July, the U. S. Soil Conservation Service had laid plans for experimental aerial soil surveys. It was hoped the billion mile task would move 4 to 13 times faster—cost 14 to 30% less when done by air.

▶ **Air Tours**—Of equal significance was a notable tendency for farmers to use aircraft for self education—to study their management and soil problems from the sky. Toward the end of the best flying weather last fall, reports to the U. S. Soil Conservation Service indicated at least 300 "conservation air tours" had been held, with a few more scheduled in the South and Southwest. At this rate, 50-60 000

U. S. Civil Aircraft 1951

Non-Carrier Aircraft	
Agricultural (farm and ranch use)	7 481
Agricultural (commercial use seeding spraying etc.)	4 234
Industrial (photography survey patrol medical prospecting, etc.)	3 151
Industrial (advertising)	486
Instructional	11 819
Transportation for hire (passenger or cargo including charter contract, irregular jitney etc.)	3,375
Business	18,244
Federal state and local governments	1 068
Pleasure and sport	10 881
U S aircraft out of U S	836
Total	**69,544**
Air carriers and inactive aircraft	33,385
TOTAL REGISTERED AIRCRAFT ACTIVE AND INACTIVE	**92,855**

SOURCE CAA Aircraft Use Survey—1951

people would have taken an air look at their neighboring agricultural land by year's end.

The air tour idea is usually credited to the National Flying Farmers. The first tour was held in Oklahoma several years ago. Since then, the airplane has established itself as conservation's best "sales booster."

Air soil tour attendances of 2-3,000 people in farming communities have been experienced. District conservationists or county agents usually map out the route, arrange for ground markers, programs and maps.

But the pilot is the key man, the teacher in a flying classroom. Ordinarily, it doesn't take him long to point out erosion, drainage systems, terraces, grassed waterways, overgrazed pastures, contour strip crops and insect damage.

Ground events include agricultural and conservation movies shown in the hangar, demonstrations of farm implements and machinery, talks by farm leaders and related experts. Aerial applications of fertilizer, insecticides and seeds usually please the crowd.

▶ **Popular Idea**—Tour flights average 20 to 30 minutes. To fly a maximum number of people at 800- to 1,200-foot altitudes where ground culture is best observed, the 4-place ship has proved most effective. Smaller craft may be used, but larger planes penalize maneuverability and visibility for the tourists. The big planes also detract from the "personally conducted" appeal.

Twenty nine 4-seaters were used in flying 235 conservation tourists in a one-day event in Ohio—this gives a rough idea of facilities required for the necessary accommodation.

Wherever held, air conservation tours have clicked, Soil Conservation Service officials say. Forty soil conservation districts in Ohio which held them in 1950 repeated in 1951. They were joined by 30 other districts in the same state. Eight states in the upper Mississippi Valley recently set up a permanent program of air soil tours.

Operators with an eye for the future welcome the trend. It gives them the chance to show the airplane doing a job only it can do. It attracts thousands of newcomers to the airport. It has placed aviation in very favorable light as an effective ally for agriculture a national enterprise in which everyone has a stake.

Airports by Type

State	Mun.	Comm.	CAA	Mil.	Mun. Civil	Private	Total
Ala.	38	31	0	16	2	7	94
Ariz.	44	24	1	96	9	22	174
Ark.	34	23	0	0	0	37	94
Calif.	161	100	4	40	19	139	463
Colo.	84	29	3	2	0	18	136
Conn.	9	13	0	0	0	4	26
Del.	2	0	0	1	0	7	10
D. C.	1	0	0	2	0	0	3
Fla.	86	30	2	47	2	8	175
Ga.	66	13	1	10	0	33	113
Ida.	32	11	0	1	27	30	101
Ill.	43	106	0	4	0	18	171
Ind.	26	86	0	4	0	10	126
Iowa	37	42	1	2	0	64	105
Kan.	96	33	0	3	0	39	184
Ky.	14	19	0	2	0	16	51
La.	37	15	0	4	0	33	89
Me.	36	19	0	4	0	18	66
Md.	7	36	0	0	1	15	46
Mass.	26	42	0	6	0	4	74
Mich.	130	70	0	8	2	36	246
Minn.	84	31	0	1	1	0	117
Miss.	36	27	1	2	0	18	84
Mo.	46	40	1	1	0	18	106
Mont.	31	18	1	1	15	5	71
Neb.	73	80	1	1	1	27	184
Nev.	12	13	0	5	24	11	71
N. H.	13	16	0	1		0	30
N. J.	6	61	0	4		6	78
N. M.	26	17	8	6	4	30	95
N. Y.	48	114	1	3	0	74	240
N. C.	36	19	0	11	2	13	130
N. D.	64	33	4	0	1	27	131
Ohio	42	140	2	4	3	31	223
Okla.	54	34	0	5	0	24	117
Ore.	43	31	2	1	12	32	123
Pa.	46	138	1	6	6	17	208
R. I.	2	5	0	2	0	0	10
S. C.	36	10	1	5	1	5	58
S. D.	38	17	0	1	0	7	73
Tenn.	26	30	1	5	5	10	80
Tex.	188	225	4	44	8	297	641
Utah	37	8	0	5	1	4	80
Vt.	10	10	0	1	0	0	21
Va.	58	62	1	14	2	22	151
Wash.	72	47	1	11	8	26	170
W. Va.	14	25	2	0	0	14	55
Wis.	64	43	2	1	0	15	107
Wyo.	34	10	2	0	1	0	63
Totals	2 314	2 052	98	342	148	1 328	6 236

SOURCE: CAA

U. S. Helicopter Designations

Company	Commercial Designation	No. of Place	Engine (Make)	Hp.	USAF	Army	USCG	USMC	Navy
Bell	47	2	Franklin	178	YH-15	YH-13	HTL-1	HTL-1	HTL-1
	47B	2	Franklin	178	H-13H	H-13H	HTL-2	HTL-2	HTL-2
	47G	2	Franklin	200	H-13C	H-13C	HTL-3	HTL-3	HTL-3
	47D 1	3	Franklin	200	H-13D	H-13D	HTL-4	HTL-4	HTL-4
	47D 1	3	Franklin	200	H-13E	H-13E	HTL-5	HTL-4	HTL-5
	42	10	P&W	600	YH-12				
	61	3	P&W	1200					XHR2
Doman	LZ-4	8	Lycoming	400					
	LZ-5	2 to 5	Lycoming	400					
Hiller	UH1B	3	Aircooled	178		H-23A			HTE-1
	UH12A	3	Aircooled	200		H-23B			HTL-2
Hughes	XH-17								
Kaman	K-240	3	Lycoming	245				HTK-1	HTK-1
	K-5	4	Continental	528				HOK-1	HOK-1
McDonnell	36	1	McDonnell	ramjets	XH-20				
	79	1 to	McDonnell	ramjets					
Piasecki		19	P&W	600			HRP-1	HRP-1	HRP-1
		20	P&W	600				HRP-2	HRP-2
		8	Continental	525					HUP-1
		6	Continental	550					HUP-2
		6	Continental	550		H-25A			
		10	Wright	1,150	YH-21				
		10	Wright	1,150	H-21A				
		20	Wright	1,425	H-21B	H-21B			
		42	2 P&W	1,050 ea	XH-16				
Sikorsky	S-51	4	P&W	450	H-5		HO3S	HO3S	HO3S
	S-52-2	3-4	Franklin	245		YH-18	HO3S	HO3S	
	S-55	10-18	P&W	600	H-19	H-19	HO4S	HRS	HO4S
	S-56							HR3S	

*Classified

SOURCE Helicopter Council of Aircraft Industries Assn.

Copters Win Role in Air Power

Rotor craft come of age in Korea and now new fields of utility open for both military and civil users.

By Harvey Gaylord*

Six years ago, on Mar 8, 1946, to be exact, the Civil Aeronautics Administration issued the world's first commercial helicopter license This was the spark which launched the helicopter industry on a program to include the helicopter as a new but important adjunct in the field of transportation

The inception of that program was modest and not without barriers Helicopters were unproven operationally and not even the engineers who designed them had a complete realization of their utility and potential The public was prone to regard the helicopter as a novelty

In the ensuing six years, the helicopter has come of age and its progress is almost without parallel in the history of transportation Both the industry and the military and commercial operators, who collectively had both patience and confidence in rotary wing aircraft, pioneered together

▶**Around the World** — Surprisingly enough, the process was a comparatively short one Within four years, helicopters were doing a hundred different types of jobs in more than 30 countries They were proving themselves reliable workhorses, able to achieve things impossible for any other type of vehicle and equally important, doing these things safely, quickly, and economically

At the outbreak of Korean hostilities, the military requirements for helicopters increased sharply By June 1950, less than 1,000 helicopters had been produced in this country Almost immediately thereafter, the demands on the industry multiplied until today the industry has orders exceeding $400 million

That the industry was ready to begun meeting the demands of the military was due in a large measure to the fact that at least three companies were already in production on a commercial basis, modest though it was

▶**Military First**—Industry was called upon to deliver helicopters to Korea where the capabilities of the craft were to be adequately tested under combat conditions Their work proved to be startlingly successful—new and practical uses were born out of necessity and adopted as standard operational procedures The need for speedy deliveries grew and an immediate diversion of materials and equipment into military procurement channels was accomplished in short order by the entire helicopter industry

Early deliveries to the military were taken "off the shelf" and almost the entire flow of helicopter production was diverted to support the Korean activity This action depleted manufacturers' inventories of equipment and spare parts and before it was possible to replace these stocks the Controlled Materials Plan was put into effect This prevented the manufacturers from recapturing the commercial material which has been used to expedite the early military programs

Today, the industry is producing almost exclusively for the military Consequently, commercial operators of helicopters are encountering difficulty in maintaining their equipment

▶**Commercial Need**—It is to the advantage of both the government and

*Chairman Helicopter Council AIA.. Vice President Helicopters, Hell Aircraft Corp

U. S. Registered Civil Helicopters

Nov 1, 1947	72
Apr 1 1948	104
Jan 1, 1949	146
Jan. 1 1950	170
Jan. 1, 1951	204
July 1, 1951	168

SOURCE CAA

Helicopter Industry

	1950	1951
Sales	$50 000 000	$15 000 000
Backlog	$400 000 000	$50 000 000
Employment	3 000	8 000
Plant area (sq ft.)	600 000	1 800 000[1]
Military purchases (in fiscal years)	105	2 000[2]

[1] Including area under construction
[2] Planned procurement in period ending June 30 1952 units.

SOURCE Helicopter Council of AIA

the civilian economy that commercial helicopter operators obtain at least the minimum allocations of equipment and maintenance materials necessary to continue the essential services they now render. It would also seem necessary to obtain delivery of enough new helicopters to take care of attrition and expand to the extent necessary to perform the critical tasks required in support of the national defense program.

The vast majority of commercial operations has been and is now carried on in direct support of our nation's economic structure and, in many instances, under immediate supervision of the military. For example, the Army has leased commercial crews and equipment to conduct extensive mapping operations in Alaska.

Commercial helicopters have been in general use for geological and geophysical surveys, for mapping, for agriculture, for scheduled power line patrol, for exploration leading to the discovery of vital ore and oil deposits, for scheduled air mail delivery and for many other civil applications.

▶ **Assist for the Military**—From this substantial background of commercial experience, the military has adopted many of its maintenance and operating techniques. The mountain flying experience of several commercial operators in the northern wilds of Canada has been adapted to Korean terrain.

Other military pilots have received instrument flight training based on techniques developed by one of the scheduled air mail carriers. Experience gained in Alaska where army and commercial ships have been utilized side by side has proven invaluable to pilots operating in severe Korean winter weather.

It is, therefore, obvious that all phases of helicopter operation and experience are mutually intermeshed and available to everyone in the field. Maintenance and inspection methods developed by the armed forces have resulted in increased life for commercial equipment. Military development programs now being conducted by member companies of the helicopter industry will result in more efficient new commercial machines.

▶ **Partners in Progress**—The helicopter is considered by military men as a basic work vehicle, not as a combat weapon. This premise has been amply proven in Korea through many tasks, the chief of which has been the evacuation work responsible for the saving of more than 12,000 lives.

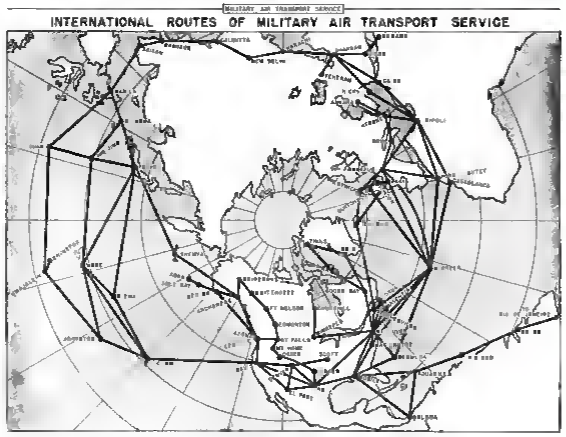
Working together in the future as in the past, the helicopter industry, the military services and commercial operators can provide for the advancement of the nation's air transportation together with extended commercial utilization in the coming age of the helicopter.

Airlift: More Planes, Manpower Needed

• MATS is doing a good job with what it has, but is a one-at-a-time airlift agency

• Military transport arm needs career setup for officers, more secure procurement position.

By William Kroger



Aircraft Assigned to MATS

Date (as of)	Transports			Other		
	USAF	Navy	Total	USAF	Navy	Total
June 30 1948	317	39	356	287	0	291
June 30 1949	356	42	398	338	4	337
June 30 1950	504	31	535	206	4	205
June 30 1951	555	43	598	554	3	558
Dec. 31 1951	527	48	572	411	4	415

SOURCE MATS.

MATS Assigned Personnel

Date (as of)	Air Force	Navy	Civilian	Total
June 1948	50 110	6,707	8 457	61 364
Dec. 1948	41 546	6,887	10 439	60 871
June 1949	47 780	6,970	13 866	54 576
Dec 1949	48 187	2,820	6,125	58,110
June 1950	47 421	2 607	8 526	58 554
Dec. 1950	58 400	3,915	8 004	98 350
June 1951	60 586	3,740	10 134	63 720
Dec 1951	77,741	3 813	10 325	91 979

SOURCE MATS

• MATS *is* doing a good job with what it has, but is a one-at-a-time airlift agency

• Military transport arm needs career setup for officers, more secure procurement position.

By William Kroger

An air transportable army is technically practical today. It may not be bureaucratically practical.

Military airlift from Japan to Korea saved U. N. forces in the Pusan perimeter, according to most authorities. Four years ago this summer, airlift saved Berlin for the Allies. Air evacuation of wounded from Korea, plus air movement of medical supplies, is largely responsible for cutting in half the mortality rate from wounds expected on the basis of World War II experience.

But there is still no evidence of national planning to use air transport to its maximum proven potential.

Seven years ago this month, Gen. H. H. Arnold, then commanding the Army Air Forces, said: "We have learned and must not forget that from now on air transport is an essential of air power, in fact, of all national power."

War planners in Washington probably would indignantly deny an accusation that they have forgotten. Yet, one man involved in the task of establishing a civilian reserve for military airlift says he was amazed at the small number of planes the military estimated it would require from the airlines in case of world-wide war.

▶ **The Contradictions**—An inquirer is assured that the top military planners, from the Joint Chiefs of Staff on down, appreciate the value and potentials of airlift. There is also an appreciation of the fact that our airlift capacity—including all the four-engine aircraft of the civil airlines—is not sufficient to supply simultaneously all the places in the world where the U. S. has vital interests. And there is also tacit admission that no effort now is being made toward building that much airlift capacity. But as one AF officer says, "There will never be enough airlift to satisfy everyone who wants it."

Persons with knowledge of military airlift capacity and plans to expand it will not comment on that apparent contradiction. They say it is linked with war plans and in the highest category of security. A careful analysis of transport air power gives a basis to speculate on reasons for present policy.

Secretary of the Air Force Thomas K. Finletter has said: "Our Air Force has four main tasks. These main tasks are, first, the air defense of the United States, second the strategic counter-attack, third, tactical air support, and fourth, air transport."

▶ **First Call**—That fourth task of the Air Force presumably is to supply air transport to any service that needs it. The Air Force is getting the highest

Passenger Miles & Ton Miles Flown by MATS

Year	Passenger Miles	Ton Miles
1948	15 187 000	8 798 305
1949	539 700 013	144 187 301
1950	600 554 720	195 718 656
1951	741 541 244	230 879 898
Totals	2 102 342 978	808 584 160

SOURCE MATS

What MATS Carried

Period	Passengers & patients	Tons cargo & mail	Total tonnage
June 1, 1948—June 1, 1949	199 000	44 000	98 000
June 1, 1949—June 1, 1950	328 000	62 000	98 000
June 1, 1950—June 1, 1951	392 000	68 000	107 000
June 1, 1951—Jan. 1, 1952	310 000	49 000	86 000
Totals	1 138 000	199 000	389 000

NOTE. These figures do not include over-all total of 2,325 518 tons delivered to Berlin, Germany over the Berlin Airlift from June 26 1948 to Sept. 30, 1949.

SOURCE MATS.

priority in defense planning. In planning airlift capacity, is it giving its own transport needs priority over needs of the other services?

The Air Force controls air transport and therefore is in a position to exercise first call on airlift capacity. So, are the other services stating their air lift requirements in terms of what they know can be carried by air, or in terms of what capacity they believe will be available after AF gets first call?

There may be several answers to these questions, and they are apparent in a study of the Air Force's methods of fulfilling its fourth main task—air transport.

Organization

The agency that supplies military airlift for all U. S. forces is the Military Air Transport Service. When it was formed on June 1, 1948, it was the first example of unification in action. Into it went basic parts of the Air Force's Air Transport Command and of the Naval Air Transport Service.

The Navy has always had planes and

men in MATS. A Naval officer has always been vice commander of MATS. An Air Force officer has always been commander of MATS. The Air Force has operational control over MATS. The Air Force supplies, money, planes and equipment for MATS.

The Air Force has other air transport responsibilities. It operates troop carrier planes, the Combat Cargo Command in Japan and Korea and the support planes for Gen. Curtis LeMay's Strategic Air Command. None of these is included in MATS.

▶ **Yardstick for Capability** — MATS missions are specified by the Joint Military Transportation Committee, which is an offshoot of the Joint Chiefs of Staff. These missions are passed along to USAF, which in turn relays them to MATS. As near as can be determined, these missions are decided on the basis of MATS capabilities. And MATS capabilities are influenced, if not actually dictated, by Air Force procurement decisions.

MATS may ask that certain planes be purchased in certain quantities. Whether they are actually bought—and they seldom have been—depends upon USAF's budget and its need for other types of planes to fulfill missions of higher priority than transport.

That may be a basic structural weakness in the organization of our military airlift. If JMTC, in addition to specifying MATS' missions, specified MATS' size and composition, there might be more airlift available at all times for all services.

The personnel of MATS is drawn from both Air Force and Navy, although Navy people with MATS are merely on temporary detached duty. For Air Force components, MATS can be a career—except for the general officers.

▶ **Command Changes** — Accordingly, the three officers who established MATS now have other assignments. Rear Adm. J. P. Whitney, first vice commander, has been succeeded by Rear Adm. Hugh Goodwin, who has now been with MATS a little more than a year. Adm. Goodwin has been a Naval aviator since 1929, and in addition wears the twin dolphins of a submariner. His service record shows wide combat experience on carriers, but no transport experience.

Maj. Gen. William H. Tunner was the original deputy commander of MATS. An airman since 1929, he organized the domestic wing of AAF's Ferry Command during the war, was the architect of the "Hump" airlift and commander of the Berlin Airlift. One of the Air Force's crack administrators, he was transferred from MATS last December to be deputy commander of an Air Materiel Command sadly in need of capable administration. His

post as deputy MATS commander has been abolished.

Lt Gen Laurence S Kuter was commander of MATS from its inception until last fall. After brilliant staff and command work during the war, he moved into air transport in 1945 as commander of ATC's Atlantic division. Prior to commanding MATS, he was U S representative to the International Civil Aviation Organization. Now he is Deputy Chief of Staff, Personnel, of the Air Force.

Succeeding Gen Kuter is Maj Gen Joseph Smith, an airman with transport experience, best proven when he was a key figure in the Berlin Airlift.

►**Experience Yet to Come**—Both Gen Smith and Adm Goodwin, on their records, are able officers. But it will, of course, take them years to gain the detailed knowledge of transport operations that is possessed by Kuter and Tunner, who between them forged the concept of global strategic airlift.

If air power is an essential of national power, as stated by Gen. Arnold, perhaps there is merit in the idea of careers in transport for military officers—especially in this period when no one knows when the U S may be called on to supply airlift in vast amounts to several widely separated parts of the world.

If the organizational structure of U S military airlift is influencing plans for use of airlift, it is also influencing—and has markedly influenced—the capabilities of our chief supplier of airlift, the Military Air Transport Service.

Capabilities

MATS is not capable today, and has not been capable in the past, of supplying all the military airlift that could be used. At the time of the Berlin Airlift, every available cargo plane was hurried to Europe while MATS officials publicly stated that if volume airlift was needed elsewhere in the world the service could not furnish it.

Today, MATS—strongly assisted by commercial carriers under contract—is performing prodigies in the Pacific. But if called upon for a comparable effort to, say, the Middle East, it could not fulfill without crippling its other services and the civil airlines. MATS is a one at-a time airlift agency.

►**The Fleet**—Well over one-half of MATS present fleet of 987 aircraft are transports. How many of the transports are four-engine types is classified, but a good guess would be slightly more than half. However, only a relative handful of these are postwar models. There are a few Douglas C-124s, perhaps a dozen Lockheed C-121 Constellations and Douglas C-74s (now obsolescent, but predecessor of the C-124). There are somewhat more Boeing C-97s.

The Navy soon will assign some Douglas R6Ds (DC-6A) to MATS. In the course of time, MATS should get some Douglas C-118s (DC-6) and Lockheed C-121Cs (Super Constellation). These planes are on order for the Air Force. How soon MATS will get them and in what quantities will depend upon Air Force needs.

Since its formation, MATS has had a program to re-equip and modernize its fleet. Its plans, as far as four-engine types are concerned, have been based on the Douglas C-124 and Boeing C-97. The Air Force has ordered some of each.

►**First Things First**—Normally, by this time, MATS should have had a sizeable fleet of both types. It does not because most of the planes have been going to the Strategic Air Command to enable it to move entire wings great distances on short notice.

This movement of SAC wings is airlift, although it is in a sense tactical airlift and therefore not the mission of MATS which is concerned with strategic airlift. Diversion of the C-124s from MATS was in keeping with Air Force commitments. The "strategic counter-attack" has number two priority in Finletter's listing of Air Force tasks while air transport has fourth rank. And giving SAC mobility certainly increases its ability to deliver the strategic counter-attack.

If the C-124 and C-97 had been ordered in quantities years ago, there might now be enough for both SAC and MATS. This could not be done because of the low priority air transport has in Air Force missions. Until the Korean war began, budgets were so small USAF had to devote its procurement funds only to the highest priority planes. And they were strategic bombers and interceptors.

The result has been a progressive decline in MATS capabilities at the same time that the utility and potential need of airlift has been increasing.

►**Reserve Factor**—As MATS meets an increased need for its services, its capability to cope with an emergency situation actually decreases. While a high daily utilization of aircraft is a sign of health for an airline, MATS spokesmen are quick to point out that MATS is not an airline and that a high daily utilization is a sign of danger.

MATS can achieve daily utilization of 15 hr. That is maximum, and if it reached that figure there would be no reserve capability for an emergency. The lowest daily utilization that permits MATS to maintain the highest proficiencies creates the best strategic airlift reserve to serve air power.

►**The Plus**—The present squeeze on both USAF and MATS has one advantage for airlift capability. In addition to being the supplier of airlift, MATS supplies a variety of services for both military and civil planes. It operates the Airways and Air Communication Service, Air Weather Service, Air Rescue Service, Flight Monitoring Service and Air Resupply and Communications Service.

These units of MATS supply communications, weather information, traffic control and other vital services for the Air Force and sometimes for the Navy, Army and airlines. They staff

Pacific Airlift Commercial Operations

Outbound, July-December, 1950

Airline	Number of Aircraft						Type of Aircraft						Passengers						Cargo (Tons)						Total Tonnage					
	July	Aug.	Sept.	Oct.	Nov	Dec.	July	Aug.	Sept.	Oct.	Nov	Dec.	July	Aug.	Sept.	Oct.	Nov	Dec.	July	Aug.	Sept.	Oct.	Nov	Dec.	July	Aug.	Sept.	Oct.	Nov	Dec.
Alaska	2	2	3	3	6	6	DC-4	DC-4	DC-4	DC-4	DC-4	DC-4	401	634	877	464	362	252	1	—	5	4	6	16	46	73	74	60	48	60
Northwest	9[1]	11[1]	11[1]	11[1]	9[1]	9[1]	DC-4	DC-4	DC-4	DC-4	DC-4	DC-4	284	424	697	1,093	904	784	43	68	73	104	26	127	73	357	287	233	96	224
Seaboard & Western	5[2]	6	5	5	6	7	DC-4	DC-4	DC-4	DC-4	DC-4	DC-4	312	765	84	576	235	466	68	46	74	48	66	134	138	128	60	120	65	192
Cal Eastern	—	2	2	2	2	3	—	OC-4	DC-4	DC-4	DC-4	DC-4	—	2	237	289	36	55	—	16	11	—	31	31	—	16	29	31	35	38
Flying Tigers	6	7	7	7	3	7	DC-4	DC-4	DC-4	DC-4	DC-4	DC-4	112	602	769	416	116	257	60	53	60	70	30	64	72	98	105	170	54	96
Overseas National	4	5	5	5	5	5	OC-4	DC-4	DC-4	DC-4	OC-4	DC-4	251	284	308	285	170	33	40	94	94	66	97	110	74	84	134	101	77	114
Pan Am	144[3] 9[4]	151[3] 2[4]	151[3] 2[4]	151[3] 2[4]	65[3] 1[4]	151[3] 4[4]	DC-4 B-377	DC-4 B-377	DC-4 B-377	DC-4 B-377	OC-4	DC-4	681 735	1,305 604	1,155 903	1,427 891	643	979	80 1	366	328	170	40	147	173 60	494 76	483 86	331 85	116	287
Transocean	8	7	7	7	6	7	DC-4	DC-4	DC-4	DC-4	OC-4	DC-4	340	451	797	905	370	374	166	105	90	8	37	60	133	161	140	110	70	107
United	4	4[5] 4	5	5	3	7	DC-6	DC-4 DC-6	DC-4 —	DC-4 —	OC-4 —	DC-4 —	629	106 664	445 —	340 —	217 —	445 —	0 5	58 30	66 —	56 —	20 —	65 —	66	70 70	140 —	124 —	58 —	140
TOTALS	94	70	66	66	37	66																								

SUBCONTRACTORS

[1] Northwest, Braniff, Delta, National, TWA.
[2] Northwest, TWA.
[3] S&W, Alaska.
[4] PanAm, Capital, American, Eastern (DC-4s)
[5] PanAm, Capital, American (OC-4s)
[6] PanAm, American Overseas (B-377)

SOURCES: MATS' Airline reports to AVIATION WEEK

Pacific Airlift Commercial Operations

Inbound & Outbound, Jan. 1-Sept. 30, 1951

Carrier	Passengers	Cargo Tons
Pan Am	35,196	2,635
NWA	9,494	2,243
UAL	7,681	2,135
TAL	6,784	2,092
S&W	6,302	2,713
Tigers	10,708	2,190
ONA	7,176	1,592
Alaska	4,016	812
CEA	1,845	722

SOURCE: MATS

Commercial Aircraft in Pacific Airlift

Carrier	Jan. 5, 1951		Mar. 20, 1951		Dec. 11, 1951	
	Type Aircraft	Number	Type Aircraft	Number	Type Aircraft	Number
Transocean	OC-4	7	OC-4	7	OC-4	7
Flying Tigers	DC-4	7	OC-4	7	OC-4	6
Overseas National	DC-4	5	DC-4	5	OC-4	4
Cal Eastern	DC-4	3	DC-4	4	DC-4	5
S&W	DC-4	7	DC-4	7	DC-4	5
United	OC-4	7	DC-4	5	DC-4	5
NWA	OC-4	9	DC-4	9	DC-4	9
Alaska	OC-4	3	DC-4	3	—	—
PanAm	DC-4	18[2]	DC-4	18[3]	DC-4	14[4]
U. S. Overseas	—	—	—	—	DC-4	3
Totals		65		66		60

[1] Includes 6 from TWA.
[2] Includes 1 from Western, 6 from American, 2 from Capital, 1 from Panagra.
[3] Includes 4 from TWA.
[4] Includes 1 from Western, 6 from American, 2 from Capital, 1 from Panagra.
[5] Includes 5 from TWA, 1 from Delta.
[6] Includes 6 from American, 1 from Capital. *SOURCE: MATS.*

Pacific Airlift
Inbound From The Entire Pacific

Month	Passengers	Patients	Cargo (tons)	Mail (tons)	Total tons
1950					
July	1 008	535	166 2	77.1	598.1
Aug	3 907	1 378	885 5	378 5	1 709
Sept	3 671	2 244	1 079 0	196.9	1 511.8
Oct	0700	2 521	764 1	320 5	1 048.5
Nov	4 657	1 792	843 2	300 5	1 078.7
Dec	9 619	5 332	884 4	280 4	1 977.0
1951					
Jan	5 825	0 224	928 5	515 2	2 169 1
Feb	4 999	3 007	979 0	330 4	2 024 5
Mar	5 261	2 251	831 0	492 4	2 082 7
Apr	5 107	1 906	358	415 5	2 132 7
May	9 074	1 931	663 5	430 5	2 092 7
June	5 877	2 613	915 0	300 0	3 090 1
July	5 098	1 280	781 1	215 4	1 936
Aug	5 585	1 515	915 5	342 2	1 920.0
Sept	5 333	1 494	854 5	310 7	1 904 2
Oct	5 805	2 292	170 2	378 0	3 350 8
Nov.-Dec.	14 777	4 153	1 790 2	606 5	4 128 7
Totals	97 909	40 079	13 658 1	6 289 1	34 107 0

SOURCE MATS

Pacific Airlift—Outbound to Japan

Carrier	Passengers		Cargo (tons)		Mail (tons)		Total tonnage		Trips	
	Dec. 1951	Total to date	Dec. 1951	Total to date	Dec. 1951	Total to date	Dec. 1951	Total to date	Dec. 1951	Total to date
Commercial (U. S.)	3 562	83 443	994 0	18 132 5	715 5	5 214 4	1 732 5	95 342 1	302	5 594
Military (MATS)	208	29 475	532 5	5 508	118	2 668 7	433 5	13 247 5	95	2 944
MCAF	5	3 178	7 1	561 5	30 0	74 0	47 5	1 315 5	15	324
Canadian Pacific	471	7 132		0			58 5	857 4	17	250
Sabena	43	415	15 3	457 5	12	320 5	90 2	804 3	7	182
Totals	5 339	129 643	332 5	23 060 5	665 5	7 825 5	2 364 7	46 066 0	486	8 867

SOURCE. MATS and airline reports.

and maintain bases all over the world, which can be used for combat purposes and transport build up when needed

Manning these units takes a good share of MATS' 91,979 personnel, but the units themselves provide a hard core for expansion As the Air Force grows and increases its flying, MATS' service functions must keep pace So the support services will already be of adequate size if MATS ever has to expand rapidly

The support personnel keep active a ready made 100,000 mile route pattern over which MATS has, time and time again, demonstrated its ability—in the face of little capability—to send supplies anywhere in the world

Performance

In performance, the only factor in military airlift over which it has dominant control, the Military Air Transport Service has been superb

The huge, spectacular operations such as the Berlin and Pacific Airlifts push MATS right into the news and bring instant, warm appreciation But in between the maximum efforts, MATS planes and pilots drone along on scores of scheduled flights daily throughout the world

▶The Record—From June 1, 1948, when it was formed, until Dec 31, 1951, MATS had flown 2,102,342,976 passenger miles; 569,554,160 ton miles, 1,138,000 passengers, 199,000 tons—excluding the 2,325,510 tons airlifted to Berlin from June 26, 1948, to Sept 30, 1949, by a combined USAF-RAF task force commanded by MATS Deputy Commander Gen Tunner.

MATS operated for two and one-half years, and flew 1¼ billion passenger miles before it had a fatal accident Since its formation it has had only two fatal accidents in scheduled operations Last year it was awarded the Daedelian Trophy for achieving the lowest aircraft accident rate in the Air Force during 1950

As steady and reliable as MATS' day-to day operation is, and analysis of the value of the service's performance has to

(Continued on page 115)

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U. S. Scheduled Air Transport Industry

Carrier	Employes	Payroll per year	Undistilicated route miles operated	Scheduled revenue pass. miles (000)	Number of scheduled pass. flown	Planes in scheduled service (January, 1952)
DOMESTIC TRUNK (including foreign operations)						
American Airlines	14 941	$60 000 000	19 852	5,500,000	4 900 000	17 DC-6B, 40 DC-6, 13 DC-6 air freighter, 1 DC-4 air coach, 75 Convair 240
Braniff Airways	3 600	8 558,578	10 072	361,584	302,429	9 DC-6, 4 DC-4, 13 DC-3
Capital Airlines	4 078	16 424,764	3-193	618 024	1 361,350	28 DC-4, 2 C-54, 24 DC-3, 1 C-47, 3 Super DC-3, 1 Constellation
Chicago and Southern	1 400	6 000 000	5 740	190 000	472,000	8 Constellation, 12 DC-3
Colonial Airlines	931	2 587 864	2 938	95,210	293,149	4 DC-4, 8 DC-3
Continental Airlines	580	3 383 816	2 000	111,779	291,385	1 DC-4, 10 DC-3, 5 Convair 240
Delta Air Lines	9 591	6 530 842	6 061	401 635	447 224	9 DC-4, 17 DC-3, 7 DC-6 (all cargo), 8 C-47
Eastern Air Lines	8 800	N. A.	11 740	1,6Bb 481	5 000 000	14 DC-4, 40 DC-3, 2 C-47, 20 Constellation, 8 Super Connie, 8 Silver Falcon (Martin 4-0-4)
Inland Air Lines[1]						
Mid-Continent Airlines	1 338	4 861 936	4,852	122 648	441 115	36 DC-3, 4 Convair 240.
National Airlines	2 403	9 992 113	9 533	436 424	712 403	6 DC-6, 8 DC-4, 2 C-46, 11 Lodestar
Northeast Airlines	757	5 163 897	1 051	97 507	454 784	7 DC-3, 8 Convair 240.
Northwest Airlines	5 877	24 485 332	10 802	602 221	790 652	36 DC-4, 4 DC-3, 10 Stratocruiser
Trans World Airlines	10 561	55 000 000	23 137	1,674 274	2 077 645	15 DC-4, 51 DC-3, 35 Connie, 12 Martin 202, 8 Martin 404
United Air Lines	11 474	40 603 900	N. A.	3,915 603	2 892 193	43 DC-6, 7 DC-6B, 23 DC-4, 55 DC-3, 8 Stratocruiser
Western Air Lines	1 450	6 236 887	5 010	250 094	261 222	5 DC-4, 10 DC-3, 10 Convair 240
Total	72 812	$293 060 079	113 061	11 251 291	28 843 883	
TERRITORIAL INTERNATIONAL						
Caribbean-Atlantic Airlines	178	$447,136	888	7 664	95,773	3 DC-3.
Hawaiian Airlines	473	1 454 782	374	44 507	243,542	11 DC-3, 3 C-47
Panagra	† 554	6 827 000	7,000	122 000	120,000	5 DC-6, 4 DC-4, 10 DC-3.
PAA	13 876	57,773 000†	6 000	1,674 000†	1,288 000†	45 DC-4, 6 DC-4 cargo, 11 DC-2, 16 Constellation, 28 Stratocruiser, 14 Convair 240, 9 C-46.
Trans-Pacific Airlines	342	677,654	N. A.	17 000	135 540	8 DC-3.
Total	15 329	$66 728 690	14 061	1 972 000	1 887 768	
FEEDER						
All-American Airways	535	1,788 858	3,071	30 866	813,896	12 DC-3
Bonanza Air Lines	130	322,434	552	7 537	29,522	4 DC-3A
Central Airlines	293	914 381	1 091	20 010	40,063	7 DC-3, 3 C-46.
Empire Air Lines	118	330,000	953	9,621	42,792	5 DC-3
Frontier Airlines	533	2 107, 113	3 385	27 374	105,394	10 DC-3.
Lake Central Airlines	177	682,153	960	25 026	32,902	2 DC-3, 1 C-45, 1 Beech Bonanza.
Mid-West Airlines	45	150 000	1 290	607	9-609	6 Cessna 190.
Ozark Air Lines	321	992 000	2 132	9,130	99 507	8 DC-3.
Piedmont Airlines	468	1,505 000	1,896	44 879	149,531	13 DC-3
Pioneer Airlines	446	1,787,630	1,934	42,106	161,856	11 DC-3.
Robinson Airlines	243	815 402	910	17 485	108,335	9 DC-3
Southern Airways	426	930 613	2 093	17,196	95,572	10 DC-3
Southwest Airways	306	1 245 257	1 152	27 286	102,821	10 DC-3
Trans Texas Airways	372	1 275 691	2 311	10 302	77,505	10 DC-3
West Coast Airlines	160	490 000	764	11 025	78 000	5 DC-3.
Wiggins Airways	34	132 850	645	382	4 088	3 Cessna T-50
Wisconsin Central Airlines	283	† 967 406	1 809	18 302	98,266	9 DC-3.
Total	8 677	$18 398 386	28 898	324 831	1 490 827	
MAIL & CARGO CARRIERS				Mail on cargo ton miles (000)	Mail on cargo (tons)	
Airnews, Inc.	N. A.	N. A.	N. A.	N. A.	N. A.	N. A.
The Flying Tiger Line	1,731	$6 800 000	10 000	50 000	10 000	12 C-54, 25 C-46.
Helicopter Air Service[2]	64	166 446	N. A.	N. A.	N. A.	2 Bell 47D
Los Angeles Airways[2]	41	101 613	317	29	N. A.	3 Sikorsky S-51
Riddle Airlines	103	800 686	N. A.	8 075	5 537	4 C-46.
Slick Airways	1,525	6 300 000	N. A.	87 000	38 948	2 DC-4A, 21 C-46
U. S. Airlines	N. A.	N. A.	N. A.	N. A.	N. A.	N. A.
Total[3]	3 445	$15 098 297	10 607	105,787	90 332	

[1] Inland Air Lines figures included with Western Air Lines.
[2] Mail only. N. A.— Not available.
[3] Estimate.

SOURCE. Airline reports to AVIATION WEEK

MATS (continued from page 108)

emphasize the Pacific Airlift.

The Berlin Airlift stirred key military and public figures to ponder the possibilities of performing the kind of airlift that Kuter, Tunner and their group already were convinced was practical. The Pacific Airlift can have left little doubt they were right.

▶ **The Long Lift**—In the first year of operation, the Pacific Airlift flew to Japan about 28,000 tons. The Berlin Airlift hauled that much in five or six days. But there was a tremendous difference in the two operations—about 6,700 miles. The Frankfurt-Berlin distance is 280 miles. The average Pacific Airlift route is 7,000 miles.

The number of tons airlifted to Japan has not been as important as the proof that an airlift could be sustained over such a long distance, and the proof that reserve airlift capacity not only is desirable, but necessary and practical.

MATS, in its normal Pacific operations pre-Korea, had been delivering about 70 tons of cargo a month to the Far East. Within three months, Pacific Airlift planes were depositing 106 tons a day in Japan alone. And in addition, MATS has been able to maintain most of its normal world-wide flight schedules.

▶ **Use of Reserve**—The feat has been accomplished by use of commercial carriers and planes of other United Nations, which have carried more than have MATS planes. In the first rush to fly supplies to Japan, MATS chartered a Pan American Airways plane. Soon thereafter, MATS entered into contracts with a number of carriers for specified trips per month. The first flight under contract, operated by Seaboard and Western Airlines, left Travis AFB, Calif., a week after the Korean war began. Before the end of July, 1950, there were 54 commercial planes on the Pacific run.

Because the war in Korea is officially a United Nations war, a scattering of foreign-owned planes has also performed valuable service on the Airlift. The Royal Canadian Air Force also contributed planes.

While the foreign planes have not been used as much as those of U. S. airlines, their very presence indicates the basic soundness of the overall mobilization plan, a feature of which is to encourage foreign carriers to purchase U. S. built aircraft, with the hope that when and if the planes are needed, the foreign lines will consider that there is a debt of honor to be paid. To the extent that such a philosophy actually pays off in practice, the airlift reserve is that much strengthened.

The smooth integration of MATS and commercial carriers into a fearfully long strategic airlift is a triumph for MATS plans for rapid expansion whenever an emergency dictates. Its procedures are agreed upon, its support services functioning and its personnel trained. The only thing it needs, come expansion day, is planes. And, as already reported, the civilian reserve is not unlimited.

▶ **The Lesson**—After the Berlin Airlift had ended, the Combined Airlift Task Forces summed up its report with words that undoubtedly reflected the Tunner view: "... Cargo and personnel can be carried between any two points in the world, regardless of geography or weather. The same personnel, the same aircraft, and the same techniques could be used to transport freight across the Atlantic or between New York and the North Pole. The only limiting factors are the availability of equipment and trained personnel. The mass movement of cargo and/or personnel in a sustained effort, anywhere, any place and at any time is not only possible, but will undoubtedly become a vital factor in any future operation."

The "availability of equipment" is the limiting factor that is worrying those who have seen what military airlift can do, and have been convinced.

Airlines

- Expanding fleets of both cargo and passenger carriers increase airlift reserve.
- But big problem in emergency would be reshuffling planes to keep airlines in business.

The size of the commercial airline fleet, particularly the number of four-engine planes, determines the reserve strength of the Military Air Transport Service.

Because of that, MATS emergency airlift capacity is expanding faster than an examination of MATS alone might indicate.

▪ The scheduled passenger airlines' present fleet has gained in numbers over a year ago. It consists of more modern planes, more four-engine planes, it has greater capacity for passengers—and, in an emergency, for freight.

▪ The all-freight lines have increased capacity, too, with the first commercial cargo plane built for the purpose, the Douglas DC 6A, going into service last year.

▪ The large irregular carriers, principally busy with military charter work on the Pacific Airlift and within the U. S., had neither the means nor the opportunity to increase capacity, although that situation will change slightly in future years.

Perhaps more significant to the future of military airlift and more indicative of where the airlines fit into present plans for mobilizing airlift when needed, are the orders for new planes now on the manufacturers' books.

The Good Times

The 400 transports on order on Dec. 31 comprised the largest backlog of that type ever owned by the manufacturers. Even one large irregular carrier, Seaboard and Western Airlines, has placed an order for new planes, Lockheed 1049Cs.

This splurge of fleet re-equipment fits nicely into the programs of the military airlift planners. To some extent they may claim credit for it. But it is fortunate that the state of the nation's economy and the activities of the airlines themselves have been working in favor of the planners.

▶ Business Booming—More passengers are riding the airlines now than ever before. Higher individual incomes have helped; so, too, have the lower air fares—family fares and coach services—at a time when some rail fares were rising.

Defense work always requires fast transportation of men and goods, and

this also has had an effect. The forthcoming Atlantic coach service indicates a need for more long range transports, some of which have been ordered.

And, for a change, the carriers are in a position to pay for new planes without the financial stress of the postwar days.

▶ **The First Billion**—The 29% increase in passenger miles for all airlines poured the greatest revenue in its history into the industry—more than $1 billion. Even after heavy taxes, it is estimated that the scheduled lines alone will net about $48 million, another new high. Despite rising operating costs, the airlines still will be able to pay for much of their new equipment out of revenues.

1951 EARNINGS

CARRIER	NET INCOME (Millions Omitted) 1950	1951†
American	$10 49	$10 18
Braniff	1 09	1 09
Capital	1 07	1 77
C&S	0 86*	0 74*
Colonial	(0 31)	0 39
Continental	0 19	0 32
Delta	0 82	1 32
Eastern	8 20	7 10
Mid-Continent	0 26	0 16
National	2 56	2 35
Northeast	0 42	0 33
Northwest	(0 14)	1 29
TWA	5 40	5 06
United	5 43	5 16
Western	0 78	1 31*

NOTES †*Estimated,* **Includes non-recurring profits,* ( ) *Deficit.*

The good financial record evident all through 1951 made orders for new planes a good gamble for airline management. They were further encouraged to take the risk by a government ruling that permits them to depreciate new planes over a five year span rather than in seven years, the period used by most carriers.

The result is that the carriers can charge off their new equipment in the peak revenue times—high tax years—thus decreasing their payments to the government.

This ruling is a keystone in the government's plan to erect a strong civil reserve for military airlift.

The Mobilization Plan

Very unofficial, but nonetheless real, is the fact that the huge backlog for transport planes is actually a military backlog to be paid for by civilians for use by civilians.

▶ **One Goal**—Acutely short of almost everything that flies, the military has comparatively little money to spend on transport planes for which there is no immediate need. On the other hand, the airlines have the money—or can raise it—for transport planes for which

U. S. Domestic Passenger Carrier Operations, 1945-51

Year	Revenue passengers (unduplicated)	Revenue passenger miles (000)	Express ton miles	Freight ton miles	Mail ton miles
TRUNK					
1944	9 979 642	3 339 279	20 009 783	1 165 534	94 998 504
1945	11 889 817	5 903 111	23 851 668	14 493 191	32 867 976
1947	12 263 018	8 102 578	26 833 392	35 913 990	32 876 823
1948	12 324 038	8 923 540	29 768 883	70 437 911	37 809 922
1949	14 021 047	9 842 980	27 329 361	94 189 501	40 874 188
1950	18 198 371	7 471 605	38 929 197	113 909 780	46 316 755
1951 •	20 831 981	10 215 977	40 644 570	99 224 495	63 321 342
FEEDER					
1944	4 452	1 312	11 482		76 010
1946	25 119	9 812	24 384	25	90 468
1947	364 385	46 419	117 323	62 639	107 964
1948	423 695	57 028	189 564	264 794	261 064
1949	577 917	134 691	330 167	435 649	473 740
1950	987 990	200 939	614 190	714 421	561 529
1951 •	1 493 196	295 436	820 897	919 131	794 253
TERRITORIAL					
1944	194 957	54 495	325 868	181 814	90 917
1946	209 719	38 053	119 372	389 499	25 243
1947	379 597	49 536	115 774	584 925	39 756
1948	418 572	52 264	134 496	581 122	53 460
1949	381 549	47 104	134 121	602 854	70 910
1950	496 386	60 649	119 000	864 901	96 188
1951 •	877 880	90 428	90 068	872 063	91 245

•—1951 figures estimated.
SOURCE Air Transport Assn

U. S. Passenger Airline Operations

Year	Total passenger miles (000)	Revenue passenger miles (000)	Express and freight ton mile: Total	Express‡	Freight‡	Mail ton miles
INTERNATIONAL						
1943	254 374	244 230	9 088 325	N A	N A.	1 063 718
1944	382 123	340 574	6 907 137	N A	N A.	2 048 150
1945	452 150	447 068	4 717 011	N A	N A.	3 206 339
1946	1 330 186	1 199 741	19 906 408	N A	N A	9 141 451
1947	1 863 268	1 810 045	32 980 413	30 790 408	2 190 048	12 755 995
1948	1 991 784	1 886 997	45 902 801	41 891 153	4 011 648	17 202 885
1949	2 168 739	2 063 995	54 158 564	49 444 130	4 714 414	19 773 210
1950	2 338 894	2 205 309	60 592 604	55 512 796	5 079 808	21 188 900
1951•	2 705 469	2 532,220	96 945 801	45 597,738	24 400 865	22 130 407
DOMESTIC‡						
1933	127 433	N A.	580 812	N A.	N A	N A
1938	174 900	N A.	422 500	N A.	N A	N A
1934	199 606	N A	597 265	N A	N A	2 237 179
1935	316 336	N A	1 097 602	N A	N A	4 123 739
1936	438 963	N A.	1 905 794	N A.	N A.	6 791 436
1937	491 116	411 546	2 162 488	N A.	N A	9 093 230
1938	900 900	479 645	2 482 400	N A	N A	7 440 240
1939	756 118	653 664	2 713 000	N A	N A	8 919 726
1940	1 137 000	1 052 190	3 479 224	N A.	N A	10 117 555
1941	1 906 503	1 384 735	5 253 941	N A.	N A	13 118 010
1942	1 501 279	1 418 042	11 901 793	N A	N A	25 162 102
1943	1 670 935	1 634 135	15 139 350	N A	N A	26 001 566
1944	2 211 664	2 1 5 207	13 991 598	N A	N A.	31 120 073
1945	3 405 207	3 382 455	20 196,561	N A	N A	65 092 9218
1946	6 058 319	5 947 950	38 810 717	33 738 992	14 332 325	32 952 3674
1947	8 313 312	8 190 505	64 675 213	59 760 159	35 911 564	33 059 1754
1948	8 245 745	8 050 083	101 3 9 860	30 062 833	71 283 727	37 928 3964
1949	7 055 100	6 752 522	123 001 852	27 773 [illegible]	95 227, 983	41 418 2932
1950	8 381 748	8 002 820	151 351 050	37 270 035	114 079 045	47 009 9471
1951•	11 218 373	10 580 541	142 151 251	41 965 385	101 918 719	54 100 5238

‡ Not reported separately prior to May 1938.
‡ Re segregation prior to Jan. 1, 1947 for International, July 1945 for Domestic.
‡ Air carriers were not required to report on a ton-mile basis prior to 1938.
‡ Includes trunks, feeders and territorials; excludes cargo carriers.
• Does not include regular mail carried under special contract.
• 1951 figures estimated. N.A.—Not available.
SOURCES CAA-CAB 1932-1950, Air Transport Assn. estimates for 1951

they have a pressing immediate need. And those same planes would be just as useful to the military in case of emergency.

Seldom have two dissimilar interests had a closer desire for an end result.

To achieve that result, the National Security Resources Board in September, 1950, began an Air Transport Mobilization Survey. The job was turned over to government, industry and public representatives divided into five task groups to consider Air Transport, Training, Overhaul and Maintenance, Industrial, Business and Agricultural Flying, Airport and Airways.

▶ **About Air Transport**—After nearly a year of study, the groups reported last August. The main recommendations of the air transport group were these:

- A "war air service pattern" be adopted as the basis for minimum civil requirements in mobilization planning.
- First and second line reserve aircraft should be designated and modified, and inter-carrier transfers of equipment after M Day should be anticipated and provided for.
- Aircraft to individual airlines should be assigned on the basis of the essential needs for wartime transportation on the routes operated by such airlines, so that maximum lift is secured without regard to present distribution of aircraft types between carriers.
- Friendly foreign airlines should be wooed so that they would be willing to supplement U. S. airlift.
- Reserve planes should be four-engine aircraft with a range of 2,500 miles. These planes should be initially modified so that equipment necessary for military airlift could be installed within 48 hours.
- Prototype modification should be made by certain operators on each of the five basic four-engine transport types in order to obtain time, cost and engineering data.
- High priority should be given civil air transport requirements.

Other recommendations had to do with manpower, government organization, and priorities for passengers traveling by air in wartime.

The remarkable thing about the recommendations is not so much that they were practical but that, considering the overall mobilization effort and the fate of past plans, so many of them are being promptly followed.

The Progress

Last month United Air Lines rolled a DC-6 from a hangar at its San Francisco overhaul base. In external appearance, it was the same as the some 150 other Sixes flying the U. S. airlines. But there were some slight differences in

(Continued on page 129)

U. S. Scheduled Airline Safety

1938-1951

Year	Fatal Accidents	Passenger Fatalities	Crew Fatalities	Pass. Miles Flown Per Pass. Fatality	Pass. Fatalities Per 100 Million Pass. Miles
DOMESTIC					
1938	5	25	10	22 409 205	4 3
1939	2	9	2	53 927 538	1 3
1940	3	35	10	33 114 116	3 0
1941	4	35	9	43 053 344	2 3
1942	5	55	16	27 288 519	3 7
1943	2	22	6	77 351 575	1 3
1944	3	43	3	47 307 077	2 1
1945	1	70	11	45 740 365	2 1
1946	9	75	22	50 394 782	1 2
1947	5	106	12	31 646 286	3 2
1948	5	53	10	75 003 225	1 3
1949	4	93	11	70 032 710	1 3
1950	4	98	13	87 110 516	1 1
1951	14*	142	36	78 493 662	1 4
INTERNATIONAL					
1938	2	7	10	7 601 860	13 2
1939	1	10	4	7 826 562	12 8
1940	0	0	0		0
1941	1	2	0	94 261 841	1 2
1942	0	0	0		0
1943	1	10	4	23 437 424	3 8
1944	1	17	0	16 737 317	5 3
1946	2	17	10	19 556 343	5 1
1945	3	40	15	28 156 725	3 6
1947	3	38	10	90 163 400	1 1
1948	1	26	10	98 098 700	1 0
1949	0	0	0		0
1950	2	45	8	48 946 125	2 1
1951	1	31	9	90 648 161	1-2

SOURCE: CAB. • Estimated. * Includes four accidents in which no passengers were carried.

U. S. Scheduled Passenger Transports

Plane	1941		1948		1950		1951[1]	
	Number	Seats[2]	Number	Seats[2]	Number	Seats[2]	Number	Seats[2]
Boeing 247 D	25	250	4	40				
307	6	304	6	304	5	190		
377					40	2 700	48	3 375
Canso 190							8	30
T-50							3	25
Convair 240					110	4 760	110	4 640
Douglas DC-2	10	224						
DST	43	945						
DC-3	258	5 648	338	11 193	470	9 312	494	11 945
Super DC-3					2	56	8	56
DC-4			20	10 400	210	10 940	194	9 700
DC-6, DC-6B							145	7 975
Lockheed L-10	19	190	3	30	8	80		
L-18	18	224	11	184	11	184	11	184
L-49			43	21 501	94	2 700	52	3 756
L-649					3	190	5	310
L-749					49	2 450	51	2 948
9C							2	10
Martin 2-0-2					98	1 146	10	570
Sikorsky S-42	6	192						
S-43	4	58						
Totals	397	7 779	510	24 271	964	41 946	1 119	43 711

NOTE: Figures include certificated Alaskan carriers, exclude certificated all-cargo carriers.
[1] Estimated passenger capacity on basis of CAA statistical study.
[2] As of Nov. 30, 1951. All other figures as of Dec. 31 of each year.

SOURCES: CAA, and AVIATION WEEK survey.

Scheduled Domestic Air Coach Operations

Airline	Passengers carried			Passenger miles (000)			Load factor			Revenue		
	1949	1950	1951	1949	1950	1951	1949	1950	1951	1949	1950	1951
American Airlines		88 970	101 536		163 300	178 078		80 70%	80 30%		$4 920 000	$7 930 000
Capital Airlines	152 748	203 436	217 592	81 344	109 675	109 640	67 29%	62 89	65 62	$6 218 177	4 425 680	5 309 127
Eastern Airlines	6 807	201 169	222 751	10 171	285 758	262 023	78 30	73 84	74 43	407 344	11 647 178	11 953 526
National Airlines		70 714	102 285		72 904	89 089		70 41	64 21		3 154 203	4 416 726
Northwest Airlines	N. A.	171 188	09 227	N A.	163 209	11 904	N A.	70 40	73 50	N. A.	7 339 720	8 380 000
Trans-World Airlines	66 623	146 837	185 050	46 850	170 275	251 000	79 80	76 73	76 80	3,294 000	7 463 950	11 380 000
Western Airlines	87 395	228 981	207 066	21 673	90 399	81 646	66 79	75 46	75 53	665 000	8 958 950	8 661 000
United Airlines		148 524	216 700		53 716	104 300		60 35	79 80		3021 783	4 462 785
Total	276 620	1 321 738	1 456 823	159 338	1 037 184	1 222 567				$6 618 021	343 946 728	359 336 199

N. A. Not available.

SOURCE. Airline reports to AVIATION WEEK.

Operations of U. S. Nonscheduled Carriers

Carrier	Year	Revenue miles (000)	Total miles (000)	Revenue passengers	Revenue pass. miles (000)	Cargo (000)	Cargo ton miles (000)	Total income	Total expense	Profit or loss (before income tax)	Aircraft type operated
Aero Finance Corp.	1951[1]	661	691	14 350	16 164			$638 026	$638 139	$467	1 C-46, 1 C-47
	1950	338	336	5,841	6,764			355 232	292 485	62 747	1 C-46, 1 C-47
Aeronics Sud Americana	1951[1]	168	243			703	841	198 550	195 616	3 056	1 C-46.
	1950	164	315			1 382	760	189 530	178 063	10 189	1 C-46.
Airline Transport Carriers, Inc	1951[1]	130	131	2 629	4 958			N A	N A.	N A	1 C-54
	1950	81	86	3 503	† 464			974 877	740 893	133 634	6 DC-3.
Air Services Inc.	1951[1]	37	40	1 532	922			38 033	45 118	(7 085)[2]	1 DC-3
	1950	06	101	3 144	2 454			64 304	60 513	4 581	1 DC-3.
Air Transport Associates, Inc.	1951[1]	1 250	1 460	18 848	28 777	1 384	6 297	1 520 407	1 282 925	237 076	4 C-46.
	1950	850	958	10 386	16 237	907	1 078	811 418	807 256	74 132	4 C-46
All-American Airways Inc	1951[1]	324	295	N A	7 594			341 859	305 528	36 025	6 C-46
	1950	31	26	820	347	3	2	16 346	35 031	(18 715)[2]	† C-46
American Air Export & Import Co.	1951[1]	N A	N A.	N A	N-A.	N A	N A.	N A.	N A	N.A.	N A
	1950	129	129	33	20	645	958	992 365	865 336	126 990	3 DC-3, 1 C-46.
American Air Transport Inc.	1951[1]	661	665	24 933	37 480			616 258	555 370	60 363	8 C-46
	1950	631	665	17 832	18 860			416 591	374 220	44 371	1 C-46, 1 DC-3.
American Flyers Inc.	1951[1]	200	203	2,711	2 316	8	11	66 568	73 650	(7 081)[2]	2 DC-3 1 Lockheed.
	1950	120	160	2 200	1 920	20	101	89 531	85 420	99	4 DC-3 1 Lockheed.
Arctic Pacific.	1951[1]	N A	N A.	N A.	N A.	N A	N A	N A.	N A	N A.	N A.
	1950	178	200	16	21	432	716	186 640	197 612	(11 050)[2]	1 C-46.
Argonaut Airways Corp.	1951[1]	313	329	17 930	14 772	90	329	177 305	166 193	17 675	1 C-46.
	1950	278	359	6 807	7 584	23	66	145 483	143 765	4 718	1 C-46.
Arnold Air Service	1951[1]	N A.	N A	N A	N A.	N A	N A.	12 937	18 224	(5 287)[2]	N A.
	1950	146	166	2 071	3 020	32	135	128 613	130 566	(01 342)[2]	1 C-46,
Associated Air Transport, Inc	1951[1]	190	205	2 163	2 730	208	278	178 474	177 994	480	1 C 46
	1950	18	23	125	101	66	80	20 076	32 086	993	1 C-46,
Aviation Corp. of Seattle	1951[1]	73	77	1,388	5 757			187 090	185 059	8 991	2 C-46.
	1950	264	347	6 686	11 302	79	75	238 272	310 381	(46 109)[2]	†
Blair Air Lines Inc	1951[1]	124	141	2 685	2 566			68 154	90 377	(2 133)[2]	1 DC-3.
	1950	141	147	3 170	3 087			78 253	77 147	(4 958)[2]	1 DC-3
Capitol Airways, Inc.	1951[1]	123	173	2 930	2 341	43	82	330 090	333 178	(2 083)[2]	6 DC-3 1 C-46 2 Beech 35.
	1950	81	166	1 950	1 214	148	311	338 723	325 621	10 101	8 DC-3 1 C-46 3 Beech 35.
Caribbean Amerikan Airlines Inc.	1951[1]	726	734	30 202	32 292			1 330 805	1 003 163	936 706	4 C-46, 1 DC-4
	1950	80	80			197	170	81 870	88 641	2 718	† C-46
Central Air Transport Inc	1951[1]	950	955	13 084	18 000			308 029	999 950	(51 921)[2]	† C-46
	1950	167	187	4 230	6 280			207 132	261 011	(14 770)[2]	2 C-46.
Coastal Cargo Inc.	1951[1]	923	834	3 369	5 464	930	764	865 048	292 628	72 418	2 C-46
	1950	394	360			1 563	1 102	238 237	221 713	16 524	2 C-46 1 DC-3.
Conner Air Lines Inc.	1951[1]	287	351	8 222	8 098	716	1 098	327 920	290 993	36 927	2 C-46
	1950	141	209	730	† 016	900	1 154	129 945	120 937	9 008	2 C-46
Continental Charters Inc.	1951[1]	835	1 016	20 852	08 242	202	356	572 409	903 636	58 773	3 C-46
	1950	646	1 080	16 213	24 950	568	542	442 497	433 780	8 747	3 C-46
Economy Airways Inc	1951[1]	483	484	6 231	13 642			402 777	432 956	29 806	1 C-46 1 DC-4 (for 1 trip)
	1950	241	293	7 789	12 748			160 770	154 323	6 446	1 C-46, 1 DC-3.
Federated Air Lines	1951[1]	N A	N A.	N A.	N A.	N A.	N A.	816 158	817 094	6 094	N A
	1950	N A	N A.	N A.	N A	N A.	N A.	129 430	130 230	(3 340)[2]	N A.

(Continued on page 126)

Operations of U. S. Nonscheduled Carriers

Carrier	Year	Revenue miles (000)	Total miles (000	Revenue passengers	Revenue pass. miles (000)	Cargo (tons)	Cargo ton-miles (000)	Total income	Total expenses	Profit or loss (before income tax)	Aircraft types operated
Freight Air Inc	1951[1]	N A.	N A.	N A	N. A	N A	N A.	865 348	880 337	$14 989	N A.
	1950	28	74	3 577	2 901			98 705	134 188	35 433	N A.
General Airways Inc	1951[1]	864	864	1 349	2 175	444	655	382 535	286 838	95 717	2 DC-3
	1950	468	476	1 801	2 366	350	690	294 588	242 713	51 875	2 DC-3
Great Lakes Airlines	1951[1]	N/a	580	20 423	24 098			N A	N. A.	N A	1 C-46, 1 DC-4
	1950	622	628	23 850	42 147			1 064 022	1 109 732	5 290	1 DC-4
Hemisphere Air Transport	1951[1]	143	146	1 807	3 195			117 185	117 491	(243)[3]	1 DC-3
	1950	17	18	278	334			19 908	10 331	(323)[3]	N A
Johnson Flying Service Inc	1951[1]	168	199	882	236	198	950	241 534	238 428	3 205	1 Twin Beech 24 single engine, 2 C-42, 4 Ford Tr. 2 copters.
	1950	109	144	483	240	609	1 950	299 020	340 460	41 370	2 C-47, 3 Ford Tr. 2 copters, 25 single engine.
Kesterson Inc.	1951[1]	223	223	5 632	5 280			151 104	187 690	8 405	1 DC-3.
Los Angeles Air Service	1950	51	51	1 404	1 218			84 276	82 490	1 776	1 DC-3.
Meteor Air Transport Inc.	1951[1]	220	221	7 190	12 570	N A.	N A.	521 563	447 374	74 189	N A.
	1950	340	401	19 043	18 270			901 933	777 985	123 947	1 DC-3, 2 DC-4
Miami Airline Inc.	1951[1]	336	393	95	57	2 794	1 500	249 873	277 237	(27 364)[3]	2 DC-3 1 C-46
	1950	521	564	495	202	3 900	1 844	328 812	322 621	6 191	2 DC-3 1 C-56
Modern Air Transport Inc	1951[1]	832	925	21 699	90 112	866	290	716 085	641 160	72 395	1 DC-3 3 C-46
	1950	734	853	11 850	10 419	1 144	371	435 076	438 313	(3 237)[3]	1 DC-3 3 C-46.
Modern Air Transport Inc	1951[1]	417	425	13 953	22 819			587 934	597 788	(10 954)[3]	1 DC-4 2 C-46
	1950	950	965	24 895	33 173			1 257 853	1 120 241	137 612	2 DC-4, 1 Boeing Stratoliner
Monarch Air Service	1951[1]	155	155	3 950	11 067	33	53	774 093	738 003	36 090	N A.
	1950	586	586	10 965	19 305	80	28	1 901 833	1 691 243	500	3 DC-3 1 Lockheed 2C 49, 3 single engine.
New England Air Express Inc	1951[1]	878	878	13 760	30 182	84	110	N. A	N A	N A.	2 C-46
	1950	779	800	13 129	22 784	94	88	741 703	694 141	47 635	2 C-46
Overseas National Airways	1951[1]	2,273	2,329	7,199	38 879	1,388	8 366	3 553 095	3,257 286	295,809	8 DC-4.
	1950	1,437	1,484	3,150	12 974	313	6,796	2 266,728	2,212 900	(53,872)	5 DC-4.
Paul Mantz Air Services	1951[1]	57	62	581	190	40	5	144,478	130 281	14 227	N A.
	1950	109	112	1,130	423	15	3	164,219	147 845	16,365	1 L-12, 7 single engine.
Pearson Alaska Inc. (World Wide Airlines)	1951[1]	N A	N A					90,624	89 831	6,793	N A
	1950	110	113	2 248	4 051			111 247	111 735	(492)[3]	1 DC-4.
Peninsular Air Transport	1951[1]	450	600	16,552	21 005			923 202	899 758	31,444	2C-46
	1950	585	699	18 799	21 897			723 158	677 826	46,356	4 C-46, 1 C-47 1 A 30.
Quaker City Airways Inc	1951[1]	82	95	0	117	218	202	60 340	51 520	(1 520)[3]	N A.
	1950[2]	126	130	564	629	444	377	79 078	85 940	14 068	1 DC-3.
Rommart Worner, Inc	1951[1]	4	4	13	9			532 053	486 040	144 044	3 Beech Bonanza, 1 DC-3
	1950	14	14	38	81	8	3	371 708	397 385	11 519	1 DC-3
Robin Airlines	1951[1]	N A	N A.			N A	N A	N A.	N A	N A	N A.
	1950	475	475	9 918	21 250			734 382	845 387	109 005	2 C-46 1 DC-4, 1 DC-3
Seaboard & Western Airlines Inc	1951[1]	4 025	3,748	3,127	49 301	8 190	90 418	8 416 057	7,402 894	1,307 053	4 C-54 3 C-46
	1950	3 994	5 255	10-012	49 253	1 911	9 459	5 816 900	5,112 570	404 230	2 C-54 3 C-49
Skytrain Airways	1951	N A.	N A	N A.	N A.	N A	N A	N A	18 922	(18 522)[3]	N A.
	1950	130	130			176	750	319 178	197 350	12 822	2 C-46
Southern Air Transport	1951[1]	844	849	4 438	4 160	709	632	379 304	357 533	21 843	2 C-46
	1950	129	564			271	937	193 345	187 524	7 821	2 C-46
S. S. W Inc.	1951[1]	N A.	N A.	6 194	18 523			332 865	318 995	9 709	1 C-46
	1950	30	90	897	1 460			30 140	27 233	9 967	1 C-46.
Standard Air Cargo	1951[1]	178	190	2 151	4 378	2	5	109 253	105 522	731	1 DC-3
	1950	148	150	2 906	3 300	5	14	174 788	146 540	35 150	2 DC-3.
Stewart Air Service	1951[1]	132	N A	3 979	1 248			78 864	65 400	12 380	2 DC-3.
	1950	67	69	1 919	1 649			60 926	79 706	11 220	2 DC-3.
The Unit Export Co Inc.	1951[1]	95	63	531	201	332	142	53 657	58 063	(4 389)[3]	1 C-46
	1950	48	50			685	282	80 778	67 149	(18 371)[3]	1 C-46
Trans-Alaska Airlines	1951[1]	93	83	530	991	49	88	48 196	48 195		1 DC-3.
	1950[4]										
Trans American Airways	1951[1]	282	289	7 848	12 084			488 273	469 888	18 386	1 C-54
	1950	574	661	18 526	32 030			725 886	726 486	(3 670)[3]	1 C-46, 1 DC-3.
Trans Caribbean Airways Lines Inc	1951[1]	492	492	8 518	14 007	90	181	799 763	682 050	105 703	2 C-46
	1950	810	815	8 586	16 534	41	93	681 793	667 384	14 505	2 C-46
Transocean Air Lines	1951[1]	2.849	3.794	28 886	95 306	7.889	17 564	13 209,438	8,381 564	1 505 934	1 DC-3 5 DC-4 8 C-54, 15 Martin 2-0-2 7 C-54 11 Misc
	1950	4.199	4.546	27 567	88266	980	5,438	7,738 790	7,914 814	(181 024)[3]	5 C-54 1 DC-3 7 C-46 5 single engine.
Trans National Airlines	1951[1]	281	287	5 477	5,189			46 028	44 317	1 711	1 DC-3.
	1950	91	94	1 792	2,543			88 286	69 915	18 371	1 C-47.
Twentieth Century Airlines	1951[1]	1,680	1,712	61 501	107,264			3 665 910	3 633.482	32 128	1 DC-3 5 DC-4.
	1950[5]										
U S. Air Coach	1951[1]	265	268	5 887	12,172			333 186	373.100	(39 867)[3]	2 C-46 3 C-54 (for one-way trip).
	1950	170	170	3 229	7,850			357 032	349.944	(12 912)[3]	5 C-54
U S. Overseas Airlines	1951[1]	484	585	1 344	4 069	1 934	5,487	1 284 987	1 237 582	47 405	4 DC-4
	1950[5]	58	95	1 891	3 095	N A	N A.	305 278	301 274	(3.496)[3]	N A
World Airways, Inc	1951[1]	600	864	5 870	16 877	169	141	348,746	340.038	84.708	2 C-46.
	1950	524	530	16 243	21 709	59	187	375 361	405.419	(30.115)[3]	9 C-46.

[1] Figures through Sept. 30 1951 only
[2] Aircraft certificate under CAA suspension. 12/31/50.
[3] No flights operated during third quarter of 1951
[4] No operations.
[5] No operations first and second quarter 1950.
[6] Parenthesis means loss.

SOURCE. CAB.

Fatal Aircraft Accidents in 1951

Date	Location	Equipment	Operator	Passenger Fatalities	Crew Fatalities
DOMESTIC SCHEDULED OPERATIONS					
Passenger-Carrying Operations					
1/14/51	Philadelphia, Pa.	DC4	National	5	1
1/16/51	Reardan, Wash.	Martin 2-0-2	Northwest	7	2
3/ 1/51	North Amarillo, Tex.	DC-3	Pioneer	—	1
3/ 2/51	Sioux City, Iowa	DC-3	Mid-Continent	13	3
4/ 5/51	Santa Barbara, Calif.	DC-3	SWA	18	5
4/25/51	Fort Wayne, Ind.	DC-3	UAL	8	3
6/15/51	Jackson, Miss.	Lockheed 345	C&S	—	1*
6/30/51	Fort Collins, Colo.	DC-6	UAL	45	5
8/24/51	North Oakland, Calif.	DC-6B	UAL	44	5
11/27/51	Ocala, Fla.	DC-3 T-Craft (Mid Air collision)	Eastern	— —	— 1
				142	27
Other Revenue Operations					
7/ 2/51	Ontario, Calif.	Sikorsky S-51	LAA	—	2
8/27/51	Lynwood, Calif.	Sikorsky S-51	LAA	—	1
					3
Non-Revenue Operations					
9/12/51	Nr. Redwood City, Calif.	Boeing 377	UAL	—	7
12/ 4/51	Denver, Colo.	DC-3	UAL	—	3
					8
INTERNATIONAL SCHEDULED OPERATIONS					
Passenger-Carrying Operations					
6/28/51	Monrovia, Liberia	Lockheed L-049	PAA	31	5
ALASKAN OPERATORS					
Passenger-Carrying Operations					
1/13/51	North Cordova, Alaska	Noorduyn Norseman (UC-64A)	Cordova Air Service	4	
8/27/51	Seldovia, Alaska	Travel Air 6000B	Alaska Airlines	4	1
9/ 4/51	Anchorage, Alaska	Cessna T-50	Christensen Air Service	4	1
12/16/51	Barrow, Alaska	Cessna 170 A	Wien Alaska Airlines	1	1
				13	3
DOMESTIC IRREGULAR OPERATIONS					
Passenger-Carrying Operations					
12/ 5/51	Tuxemeni N. Mex.	Martin 2-0-2	Trans-Ocean Airlines	1	—
12/15/51	Elizabeth, N. J.	C-46	Miami Airlines	52	4
12/23/51	Little Valley, N. Y.	C-46	Continental Charters	21	5
				74	9
Other Revenue Operations					
7/27/51	Grand Ledge, Mich.	Beechcraft D-18S	Frasca Aviation	—	1
Non-Revenue Operations					
11/17/51	Oakland, Calif.	C54B (Mid-air collision) C54	Overseas Nationals** California Eastern	— —	3 —
					3

*Ground personnel walked into propeller
**Three automobiles were struck; seven persons received burns.

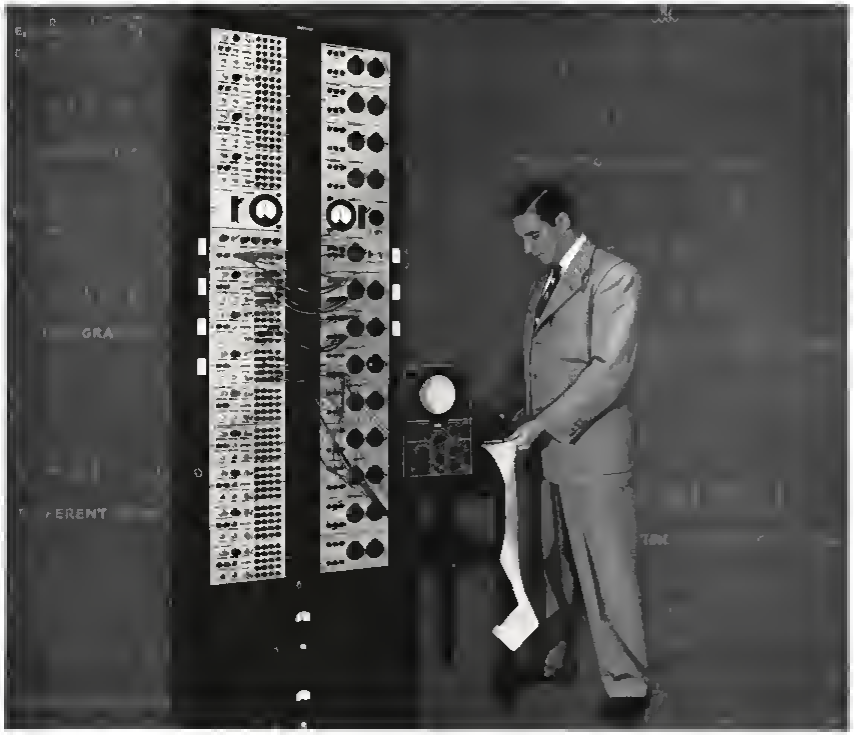
Airlines (continued from p. 120)

side, and those differences were the reason the plane was eagerly awaited by a group of interested government representatives.

It was the first four-engine airline transport modified so that equipment necessary for military airlift could be installed within 48 hours.

▶ **Basic Configuration**—This DC-6 now conforms to what the mobilization survey calls the "basic configuration." As recommended, a plane meeting this requirement would be able to carry military-type navigation and communications equipment.

The modification does not involve installing that equipment. Instead, the plane is fitted with the necessary wiring



Solving a dynamics problem with the Boeing Computer, oscilloscope at right shows result

How to expand engineering brainpower

The Boeing Electronic Analog Computer doesn't replace engineers' brains. But it multiplies their effectiveness—enables them to explore a problem in all its variations at one time, without the long, laborious process of endless mathematical calculations.

Take a problem involving inertia, acceleration, velocity, displacement and time—whether in a fluid, a mechanical system, an electrical or thermal field or any other medium. To work out such a problem by complicated mathematical equations may take thousands of engineering man hours. When the same data are fed into the electronic circuits of a Boeing Computer, accurate answers are given in a few hours!

Boeing engineers designed and built the computer as a piece of working equipment for use in guided missile development. In single or multiple units it has now become an important factor throughout the organization. It has opened the door to achievements which might otherwise have been impossible.

The computer meets a growing demand for an analog machine which can be economically and successfully operated by almost every industrial, military, research and educational group working on dynamics problems. Its simplicity, compactness, versatility and precision make it useful to engineers improving the scope and quality of their work. An increasing number of concerns not only in the aircraft industry but in other technical fields, are buying and using the Boeing Computer.

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and fixtures so that the equipment itself can be mounted on plug-in shelves that can be easily and quickly installed in the plane.

The modifications cannot add more than 100 lb. weight to the plane. The airlines would not be reimbursed for carrying this extra weight. They would, however, be paid for the cost of the installation.

▶**First Phase**—The UAL job was part of the first phase in converting a certain number of civil transports to the basic configuration. Other airlines and planes they are modifying in this initial step are: Northwest (DC-4), TWA (Constellation), Pan American (Stratocruiser).

As each plane is modified, data on the job goes to the government for study. Phase two of the project will be contracts to convert the balance of the first and second line reserve planes.

Following up with another recommendation of the task group, these first and second line reserve aircraft have already been designated. The composition of this reserve fleet is secret, as is the actual number. But it is believed to be about 60% of the four-engine planes now flying the airlines, which would put the figure in the neighborhood of 300.

▶**The Big Problem**—Since the designation of the reserve fleet, the Defense Air Transport Administration and the Air Coordinating Committee—which administer the transport mobilization program—have been wrestling with the thorny problem which would be created by diverting that number of planes to military purposes: inter-carrier transfers of equipment.

An airline whose fleet is predominantly four-engine would suffer most severely during mobilization. So if its routes were essential for wartime transportation, it would have to be supplied with twin-engine transports from a carrier which had a more balanced fleet and consequently was less seriously affected by mobilization of its four-engine planes. And right there you get into competitive, price and standardization questions that could wreck the plan.

▶**The Major Victory**—The emergency airlift potential afforded by the civil airlines draws great strength from the continued additions to the civil fleet. The more transports the airlines have, the greater reserve the military has.

That was one of the guiding influences in the task group's recommendation that "civil air transport requirements have a priority equivalent to that granted to the military under mobilization."

That recommendation probably has had the toughest sledding in an area of materials controls, but headway is being made.

Aircraft Markings Of All Nations

The following aircraft nationality marks are those filed with the International Civil Aviation Organization in Montreal as of Sept 30, 1951.

Argentina	LV
Australia	VH
Austria	OE
Belgium	OO
Brazil	PP, PT
Burma	XZ, XY
Canada	CF
Ceylon	CY
Chile	CC
China	B
Colombia	HK
Czechoslovakia	OK
Denmark	OY
Dominican Republic	HI
Ecuador	HC
Egypt	SU
El Salvador	YS
Ethiopia	FT
Finland	OH
France	F
Greece	SX
Guatemala	TG
Haiti	HH
Iceland	TF
India	VT
Indonesia	PK
Iran	EP
Iraq	YI
Ireland	EI, EJ
Italy	I
Lebanon	LR
Liberia	EL
Luxembourg	LX
Mexico	XA, XB, XC
Netherlands	PH
Netherlands Antilles	PJ
Surinam	PZ
New Zealand	ZK, ZL, ZM
Nicaragua	AN
Norway	LN
Pakistan	AP
Paraguay	ZP
Peru	OB
Philippine Republic	PI
Poland	SP
Portugal	CS, CR
Saudi Arabia	HZ
Sweden	SE
Switzerland	HB
Syria	YK
Thailand	HS
Turkey	TC
Union of South Africa	ZS, ZT, ZU
United Kingdom	G
Colonies & Protectorates	VP, VQ, VR
United States	N
Uruguay	CX
Venezuela	YV

SPECIFICATIONS OF AIRCRAFT & ENGINES

U. S. Military Aircraft

Manufacturer and Address	Model	Designation Name	Type	Number of crew	Powerplant: Number and make of engine	Powerplant: Maximum hp. at Normal rated hp.	Performance: Maximum speed (mph.)	Performance: At altitude (ft.)	Performance: Service ceiling (ft.)	Performance: Takeoff run, to safe clear 50 ft. obstacle (ft.)	Performance: Normal range (mi.)	Fuel: Normal fuel capacity (gal.)	Weights: Gross weight (lb.)	Weights: Empty weight (lb.)	Dimensions: Span	Dimensions: Length	Dimensions: Height	Wing area (sq. ft)	Remarks
French Aircraft Corp. *Wichita, Kan.*	XT-24	Meteor	Trainer	2 | 1	Con. E-225-8	225	210	19,000+	20,000+		600	60	2,700*		32' 10"	25' 11"	9' 7"		*1-S-1-P ordered 6.*
	T-30		Trainer	2 | 2	P&W R-2800	2,300		30,000+	34,000+	1,500	1,000*		35,000+		70'	48' 2"	15' 6"		*Transport version carries 18*
Boeing Airplane Co. *Seattle 14, Washington*	YB-47B	Stratojet	Med. bomb.	3 | 0	GE J47-GE-23A	5,900		600*	8,800+				185,000		116'	106'	28'		*Needs head over Los Ions.*
	B-50D	Superfortress	Med. bomb.	11 | 0	P&W R-4360-35	3,500		400+	40,000+		4,000+		168,000		141' 3"	99'	32' 1"	1,720	*Will add 3,000 lb. B-47 wings*
	XB-52	Stratofortress	Heavy Bomb.		A P&W 357 P-3								300,000+						*this design progressed.*
Gemma Aircraft Co. *Wichita, Kan*	L-19A	Bird Dog	Liaison	2 | 1	Con. O-470-11	213	109	15,000	S/L	2%	540	25	2,100	1,910	36'	25'	7'	174	*Lamp structure ordered.*
Consolidated Vultee Aircraft Corp. *San Diego, Calif.*	B-58D		Heavy Bomb.	3 | 0	P&W R-4360-41	3,800	638+	45,000+	49,000+	10,000+	3,500+	2,000	300,000+		120'	160'	47' 6"	778	*3 turrets with 20-mm. cannon.*
	XP-92A		Fighter	1 | 0	AiResearch J-83	7,000	690+	45,000+	50,000+										*All-jet swept wing B-58 development*
	XFY-1		Fighter	1 | 0	Allison J-35	5,200	600+	35,000+	40,000+										*Delta wing waterborne research*
	F-102A		Fighter	1 | 0	P&W J57-P-23	14,500	700+	50,000+	55,000+	2,700	1,500	1,000	43,000	23,000	38' 7"	68' 5"	21' 2"	661	*Delta wing interceptor with*
	XF2Y-1		Seaplane	2 | 0	Allison J71-A-4	5,600+	600+						250,000						*Transport version B2Y-1 ordered.*
Douglas Aircraft Co. *El Segundo, Calif.*	A3D-1	Skywarrior	Attack	2 | 0	Wr. J-57-P-10	20,000	600+	40,000+	45,000+		1,000+		82,000		69'	76'	22'	500	*Multi-purpose A3D-1 follows.*
	XA3D-1	Skywarrior	Attack	2 | 0	Allison J71-A-2	10,000+	610+	40,000+	45,000+										*Limited production order*
	A2D-1		Attack	1 | 0	Allison J71-A-2	7,500+	610+	40,000+	45,000+										*USAF version of A3D with CL 1755.*
	F3D-1	Skyknight	A/W Fighter	2 | 0	Wr. J-46-WE-8	8,600	650+				1,000		77,000		60'	68'	16'		*Carrier version of A3D-1.*
	XF4D-1	Skyray	A/W Fighter	1 | 0	Wr. J-67	15,000+	700+	50,000+	55,000+				50,000		50'				*Delta-wing configuration.*
Fletcher Aviation Corp. *Van N. Coldwell St. Pasadena, Calif.*	JBT-22		Trainer	0 | 1	Wr. R-1820-78	1,150	200+	20,000+	22,000+	1,400	1,300	294	9,173	7,046	39' 3"	32' 3"	9' 2"	638	*500 pct. over factory fuel.*
	FD-22		Attack	1 | 0	Con. E-225	225	190	15,000	17,000	1,100	600	90	4,200	3,228	39'	32' 11"	9' 2"	150	*Earlier model XBT-22 form*
	FD-22A		Attack	2 | 0	Con. E-225	225	190	15,000	17,000	1,100	600	90	4,200	3,228	39'	32' 11"	9' 2"	150	*Earlier model XBT-22 form*
	FT-22		Trainer	2 | 0	Con. E-225	225	190	15,000	17,000	1,100	600	90	4,200	3,228	39'	32' 11"	9' 2"	150	*40 pct. over factory fuel.*
	JBT-22		Trainer	3 | 0	3 Wr. 30C-4B	3,000	250	25,000	S/L	1,100	600	90	4,200	3,228	39'	32' 11"	9' 2"	150	*Earlier model XBT-22 form*
Grumman Aircraft Engineering Corp. *Bethpage, L. I., N. Y.*	S2F-1	Tracker	Hunter-Killer	4	2 Wr. R-1820-76A	1,525	265	20,000+	22,000+	600	2,700		27,000	20,000	69'	43' 6"	16' 4"	490	*Navy version of S-2F-1*
	AF-2S, W	Guardian	A/S/W	3 | 0	1 P&W R-4360-48B	2,400	250						49,000	14,000	69'	43' 6"	16' 4"	490	*Updated version of AF-2W*
	F9F-8	Panther	Fighter	1 | 0	P&W J48	7,250	550	S/L	40,000+				20,000		35'	46'	15'		*Modified version of F9F-6*
Lockheed Aircraft Corp. *Burbank, Calif.*	F-94B		A/W Fighter	2 | 0	All 33A-A-33	5,200	600+	45,000+	47,000+	1,000+			15,000+		36' 5"	40' 1"	12' 7"	606	*Modified T-33 with radar, wing tanks.*
	F-94C		A/A Fighter	0 | 1	P&W J48-P-6	5,200+	600+	45,000+	47,000+	1,000+			20,000+		37' 5"	41' 5"	13' 7"	637	*Pilot version, normal tail.*
	T-33A(TU-33)		Trainer	2 | 0	All 33A-A-33	5,200	600+	45,000+	47,000+	1,000+			15,000+		38' 11"	37' 5"	11' 8"	237	*Pilot version, rear tail turret*
Glenn L. Martin Co. *Baltimore 3, Md.*	P4M-1	Mercator	Patrol	8 | 0	2 Wr. R-3350-30W	3,500	300+				4,000+	4,700	80,000						*Portable pressure chamber tested*
	XP5M-1		Patrol	8 | 0	2 Wr. R-3350-30W	3,500	300+												
	XB-51	Canberra	Lt. Bomb.	3 | 0	GE J47-GE-23	5,500	600+								55'*	89'*	20'*		*Variable incidence wings.*
	B-57A	Matador	Interdict	2 | 0	Wr. J-65-W-1	7,200+	650+				400+		41,000		64'	63'	15'	960	*Built under English Electric license*
	P-6M-1	Mantis	Patrol	6 | 0	4 AE 2100		400+												*Surface-to-surface tactical missile.*
	P5M-1	Marlin	Patrol	4 | 0	Wr. R-3350	3,500	300+						170,000+	110,000	118'	96' 3"	32' 8"		*High bright-skeleton right Hull*
McDonnell Aircraft Corp. *St. Louis, Mo.*	XF-88A	Voodoo	Fighter	1 | 0	West. J34-WE-13	4,600	700		46,000+		1,400+		20,000+		39' 5"	67' 7"	17' 5"		*One still test supersonic prototype.*
	XF3H-2	Demon	Fighter	1 | 0	West. J34-WE-36	7,000+	800		48,000+		1,500+		44,000+		47' 11"	69' 3"	14' 6"		*Straight Fighter to F3H-2N*
	XF3H-1		Fighter	1 | 0	West. 880	7,000+	780		48,000+		1,000		44,000+		47' 11"	69' 3"	14' 6"		*Growth ver. of Delta build.*

U. S. Military Aircraft

Manufacturer and Address	Designation: Model	Designation: Name	Type	Number of crew	Powerplant: Number and make of engine	Powerplant: Maximum hp. at Sea Level each	Powerplant: Normal rated hp. at Sea Level each	Performance: Maximum speed (mph.)	Performance: At altitude (ft.)	Performance: Service ceiling (ft.)	Performance: Take-off run, no wind/over 50 ft. obstacle (ft.)	Performance: Normal range (mi.)	Fuel: Normal fuel capacity (gal.)	Weights: Gross weight (lb.)	Weights: Empty weight (lb.)	Dimensions: Span	Dimensions: Length	Dimensions: Height	Dimensions: Wing area (sq. ft.)	Remarks
North American Aviation, Inc. *Los Angeles 45, Calif*	F-86D[1]	Sabre	Fighter	1	1 GE J47-GE-13	5,200		696+		45,000+		500+		18,000		37' 1"	52' 3"	15' 14"	7"	554 ordered by USAF
	F-86E	Sabre	All-Weather Fighter	1	1 GE J47-GE-13	5,200		696+		45,000+		500+		18,000		37' 1"	41' 5"	15' 14"	7"	334 ordered by USAF
	T-39	Tanka	Trainer	2	2 P&W JT3C-6	5,400		560		40,000		1,200		15,000		38' 1"	37' 5"	14' 7"	275	Has tricycle landing gear
	T-28A	Savage	Trainer	2	1 Wr R-3350-AN-1	2,700		360		28,000+	1,935	900+	140	8,617	4,971	45'	28' 6"	13' 10"	208	R-3350-plus ordered by USAF
	AJ-1	Savage	Attack	3	2 P&W R-2800	2,500	2,100	360	20,000	38,000+	1,319	710+	1,125	41,381	25,111	49' 1"	52' 6"	22' 6"	298	navy ordered by USAF
	XA2J-1	Savage	Attack	3	2 AH XJ46-A-6	3,000+	2,400+	400+						52,000+	28,000+	70'+				Has 1 AE 3,635 lb. t/o, 2 J46 @ 4,000 lb. t/o. Fuselage lengthened 10 ft.
Northrop Aircraft, Inc. *1601 E. Broadway Hawthorne, Calif*	F-89D[2]	Scorpion	AW Fighter	2	2 AH J35-A-21	10,000+		600*	45,000+	45,000+	1,000+			40,000+		58' 3"	52' 4"	17' 7"	600*	Has 48-cm. fixed nose armam.
Republic Aviation Corp. *Farmingdale L. I., N. Y.*	F-84E	Thunderjet	Fighter	1	1 Wr J35-A-29	7,800+		600+		45,000		1,000+		25,000		36'	43'	14'		Swept wing F-84E development.
	F-84G	Thunderjet	Fighter	1	1 AH J35-A-29	8,200		600+		45,000+		1,000+		18,000+	11,000	36'	38'	12' 6"		Has in-flight refuel system.
	XF-91		Fighter	1	1 GE J47-GE-3*	8,200		650+		45,000+		1,000		30,000*		33'	49'	15'		Interim Super swept variable incidence wings.
Texas Engrg. & Mfg. Co., Inc. *P. O. Box 2121 Dallas 2, Tex*	YT-33	Rockaway	Trainer	2	1 Pr 6AX 165-D3	145		158	35'	17,800	875	343	33	1,978	1,490	29' 5"	21' 7"	8' 4"	184	Three ordered by USAF
Chance Vought Aircraft Division *Dallas, Tex*	AU-1	Corsair	Attack	1	1 P&W R-4360-8W	3,400		499						14,000		41'	34' 6"	14' 9"	314	Ground support type
	F4U-5	Corsair	Fighter	1	1 P&W R-4360-8W	3,400		494+	35'	40,000+		1,000	335	19,400		41'	34' 6"	14' 9"	314	Night fighter of F4U-4N
	F7U-1	Cutlass	Fighter	2	2 West.-334	3,000		650+		40,000+				22,000		39'	40'			F7U-2 has West. J-46 @ 6,000 lb.*
Bell Aircraft Corp. *Buffalo 5, N. Y.*	X-1		Research	1	1 RMI 6000-C-4	6,000		1,000	90,000	90,000+		2,400		12,000		28'	31' 10"	10' 10"	100	First to exceed Mach 1.0—14, 47
	X-1-A[3]		Research	1	1 RMI XLR-11-RM-6	6,000		1,000	70,000			4,200		12,000		28'	32' 7"	10' 6"	100	Turbine-driven fuel pump.
	X-2		Research	1	G-W rocket	15,000		2,550	100,000											Stainless-steel sweep wings. K monel fuselage tank
	X-5		Research	1	2 AH J35-A-17A	4,000		600						14,000*		32' 8"	33' 5"	8' 10"		Variable-sweep wings
Douglas Aircraft Co. *El Segundo, Calif*	D-558-1	Skystreak	Research	1	1 AE J35-A-11	5,000		641*				2,754				35'	33'	13'	180	Set record of 650.6 mph. 8 35-47
	D-558-11	Skyrocket	Research	1	1 West J46*	6,000		1,500*								35'	43' 3"	13' 6"		Has coloured nose spool, altitude marks.
	X-3		Research	1	1 West J46, rocket			2,650	800,000											Later powers, view, et sack rocket.
Northrop Aircraft, Inc. *Hawthorne, Calif*	X-4		Research	2	2 West J34	1,000		650*	16,000					7,000*		28' 10"	30' 4"	14' 10"		Semi-tailless swept wing high-transonic tests

* Data in italics are AVIATION WEEK estimates.
Aero.—Aeronautical.
All.—Allison.
ASW—Anti-sub warfare.
AW—All weather.
Con.—Continental.
C-W—Curtiss-Wright.
P.—Pratt & Whitney (Air Control Motors).
GE—General Electric.
P&W—Pratt & Whitney.
RMI—Reaction Motors Inc.
SL—Sea level.
Wr—Wright.
Wes.—Westinghouse.
W—Wright.

[1] YF-97D designed to take four Alt J71 at approx. 6,000 lb. thrust ea.
[2] Later RB-50E carries cameras; RB-50F has Shoran gear.
[3] Plus four GE J47 GE-17 at 5,200 lb. thrust ea. in twin pods under wings.
[4] Plus two GE J47 GE-17 at 5,200 lb. thrust ea. in twin pods under wings.
[5] AF-2W carries shipboard ASW radar; detection devices for locating surface vessels and subs. AF-2S carries varied armament for destroy them. The planes work in pairs.
[6] Twin-engine XSSR-2 jet patrol plane.
[7] Latest production version. F-89C is in operational service. F-89E is in the works.
[8] Plus one 6,000-lb thrust RMI XLR-11-RM-3 four-cyl. rocket motor in tail. Later XF-91A has no rocket motor reportedly has "6" tail.
[9] Duration of Flight: Duration at full power.
[10] All U. S. aircraft specific data in supersonic region X-1D was destroyed during flight test 6-23-51.
[11] Plus one 6,000 lb. thrust RMI four-cyl rocket motor in tail. Turbojet later removed in subsequent tests. Dihedral tails.

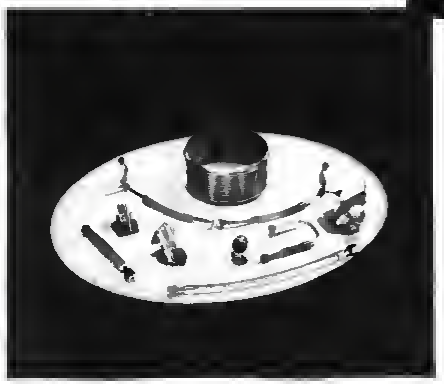
IN 1952. . . .

a new name for an established supplier

CHICAGO METAL HOSE CORPORATION

now

Flexonics *Corporation*



• Concurrently with the 50th anniversary of the company, Chicago Metal Hose Corporation is changing its corporate name to Flexonics Corporation. The expanding scope of the company's operations and products makes it desirable that we adopt a name that more truly reflects our activities. The name change involves no change in management or methods of operation except certain streamlining of procedures to make it possible to serve our many customers better. The Aircraft Division will continue to handle the many problems that exist in this highly technical aircraft industry.

Flexon identifies products of Flexonics Corporation that have served industry for over 50 years

Flexonics

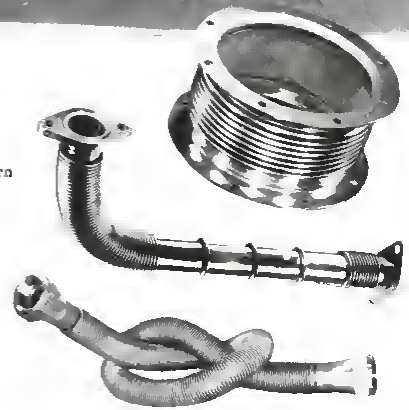
Flexonics *Corporation*

1302 S. Third Avenue Maywood, Illinois

In Canada, Flexonics Corporation of Canada, Ltd., Brompton, Ont.

Manufacturers of Stainless Steel Flexible Metal Hose,

a new plant to serve the aircraft industry



• To help meet the mushrooming demand for stainless steel flexible metal hose, bellows, ducting and flexible connections for the aircraft industry, Flexonics Corporation is putting into production a large, modern plant at Memphis, Tennessee. The new plant will supplement the company's existing production facilities at Maywood, Elgin, Rock Falls and Savanna, Illinois. Flexonics Corporation's multiple plant operation offers the aircraft industry the security of wide plant dispersal.

As in the past, experienced engineering assistance is available to help in the development of assemblies that must withstand heat, cold, vibration, motion or misalignment.

FORMERLY CHICAGO METAL HOSE CORPORATION

Plants at Maywood, Elgin, Rock Falls and Savanna, Illinois. and Memphis, Tennessee

Bellows, Ducting and Flexible Connections.

U. S. Civil and Military Helicopters

Manufacturer and Address	Designation: Manufacturer's	Designation: Military	Seats (including crew)	No. of engines, make and model	Powerplant: Takeoff hp @ SL	Powerplant: At rpm	Powerplant: Normal rated hp	Powerplant: At rpm	Powerplant: At altitude (ft.)	Powerplant: Fuel capacity (gal.)	Performance: High speed (mph.)	Performance: Cruising speed (mph.)	Performance: At altitude (ft.)	Performance: Rate of climb at gross weight (fpm.)	Performance: Hovering ceiling in ground effect (ft.)	Performance: Absolute ceiling (ft.)	Performance: Normal range (mi.)	Weights: Gross weight (lb.)	Weights: Empty weight (lb.)	Weights: Rotor disk loading (lb./sq. ft.)	Weights: Power loading (lb./hp.)	Main Rotor: No. of rotors	Main Rotor: Blades per rotor	Main Rotor: Rotor diameter	Main Rotor: Total rotor blade area (sq. ft.)	Main Rotor: Rotor rpm, cruising	Anti-torque Rotor: No. of blades	Anti-torque Rotor: Rotor diameter	Anti-torque Rotor: Area (sq. ft.)	Anti-torque Rotor: Rotor rpm, cruising	Fuselage: Length	Fuselage: Height to top of main rotor	Status
Aero-Jet-Helicopter Co., Inc. 1617 Hyperion Blvd., Los Angeles 27, Calif.	AJH-1	Pathfinder	2	1 Lycoming YO-435-1	180 @ SL	2700	150	2700	SL	36	100	90	SL	1000	12,000	12,000	200	2,500	1,500	3.5	13.9	1	2	30'	7.1	1,800	0	NA	NA	NA	20'	8'	XMO
Aircraft Industries Corp. Boonton, N. J.	Model 18		2	1 Franklin 6A4-150-B3	150 @ SL	2,800	120	2,800	SL	25	80	70	SL	500	1,000	2,000	100	1,200	1,000	3.0	6.7	1	2	24'	4.5	1,800	0	NA	NA	NA	18'	7'	XMO
Arena Helicopter Co., Inc. 1617 Hyperion Blvd., Los Angeles 27, Calif.	Model 1		2	1 Lycoming O-290-D	125 @ SL	2,900	100	2,900	SL	18	85	75	SL	500	1,000	2,000	100	1,200	1,000	3.0	8.0	1	2	24'	4.5	1,800	0	NA	NA	NA	18'	7'	XMO
Arena Helicopter Co., Inc. 1617 Hyperion Blvd., Los Angeles 27, Calif.	Model 2		2	1 Lycoming O-290-D	125 @ SL	2,900	100	2,900	SL	18	85	75	SL	500	1,000	2,000	100	1,200	1,000	3.0	8.0	1	2	24'	4.5	1,800	0	NA	NA	NA	18'	7'	XMO
Bell Aircraft Corp. P. O. Box 482, Ft. Worth 1, Texas	47D1	H-13D	3	1 P&W R-985-AN-1	300 @ 2100	2600 @ 2100	210	2,600	SL	50	100	85	SL	800	5,600	13,000	170	2,850	1,650	2.2	5.5	2	2	35'	19.2	324	3	26"	3.4	1,000	42'	9'	TP
	47G	H-13E	3	1 Franklin O-335-5	200 @ 2100	2600 @ 2100	140	2,600	SL	38	95	73	SL	400	5,500	13,000*	170	3,550	1,450	2.8	7.1	2	2	35'	24.0	360	3	26"	3.4	1,000	42'	9'	TP
	47J	H-13F	3	1 Franklin O-335-5	200 @ 2100	2600 @ 2100	140	2,600	SL	38	95	73	SL	400	5,500	13,000*	170	3,550	1,450	2.8	7.1	2	2	35'	24.0	360	3	26"	3.4	1,000	42'	9'	TP
	47B	H-13G	3	1 P&W R-1340-80	600					105	105	85	SL			6,500	400	2,900	1,900	3.2	6.3	2	2	47'	34.7	279	3	26"	3.4	1,000	47'	11'	XMO
				2 P&W R-1340-AN-1	550																												
Convertawings Inc. Amityville 7, L. I., N. Y.	B (convertiplane)		2	3 Hoeing 502						37*						5,000	1,700	3-44															
	C (convertiplane)		12	2 All TBE						720*	370					50,000	52,000	13,000	45	2	4.37												
Dagan Helicopters, Inc. Municipal Airport P. O. Box 1611, Hamburg, N. Y.	HZ-A1		7	1 Ly-Sik-540-B	400 @ 1300	350 @ 3000	85	100	SL	75	80	200	16,000	319	16,000	440	2500	1,600	2.8	4.0	2	2	44'	28.0	200	3	0.45	1950	80	11'	3'	XMO
	HZ-A		4	1 Ly-541-540-D	400 @ 2200	330 @ 3000	SL	110	105	80	SL	12,000	85,000	260	4410	2860	3	44	11	2	4.89	75	6	30	6.0	452	3	37"	10"	10'	3'	DR
Gyrodyne Co. of America St. James, L. I., N. Y.	2A		6	1 P&W R-985-B4	450 @ 2300			100	25		1100	11,000	16,000	440	4500	2,900	2	46'		3.2	16	2	2	46'		102	2	0.0	NA	NA	18'	8'4"	XMO
	Conv. version pkg. 1		10	1 P&W R-985-B4	450 @ 2300			100	25		2140	11,000	16,000	220	11,000	7,500	2	46'		3.2	16	2	2	46'		102	2	0.0	NA	NA	18'	8'4"	DR
Hiller Helicopters, Inc. Palo Alto, Calif.	UH-1B	H-23B	3	1 P&W R-985-B4	300 @ 2100	2600 @ 2100	175	46		95	94	90	SL	640	5000	11,000*	180	2265	1703	2.8	5.7	2	2	35'	19.2	324	3	26"	3.4	1,000	42'	9'	TP
	UH-1C	H-23C	3	1 Ly-O-540-A1A	260 @ 2700	2600 @ 2700	150	46		94	94	90	SL	640	5000	11,000*	180	2231	1764	2.8	6.8	2	2	35'	19.2	324	3	26"	3.4	1,000	42'	9'	TP
	HO-2		2	1 Lycoming YO-435-1	180 @ SL	2,700	150	2,700	SL	37	80	80	SL	500	1,000	2,000	100	1,200	1,000	3.0	6.7	1	2	30'	7.1	1,800	0	NA	NA	NA	20'	8'	XMO
Horizontals, Inc. 1111 Fourth Ave. Bldg., Seattle, Washington	1 W		1	1 Lycoming O-435-1	180 @ SL	2,700	150	2,700	SL	37	80	80	SL	500	1,000	2,000	100	1,200	1,000	3.0	6.7	1	2	30'	7.1	1,800	0	NA	NA	NA	20'	8'	XMO
Kaman Aircraft Corp. Windsor Locks, Conn.	K-6		3	1 Franklin O-335-5	200 @ 2100	2600 @ 2100	140	46		38	95	73	SL	400	5,500	13,000*	170	2,850	1,450	2.8	7.1	2	2	35'	19.2	324	3	26"	3.4	1,000	42'	9'	TP
	K-20		3	1 Franklin O-335-5	200 @ 2100	2600 @ 2100	140	46		38	95	73	SL	400	5,500	13,000*	170	2,850	1,450	2.8	7.1	2	2	35'	19.2	324	3	26"	3.4	1,000	42'	9'	TP
	K-225		3	1 Boeing XT-50	210 @ SL	175		46																									
	K-240		3	1 Ly O-435-4	250 @ 2400	330 @ 3000	SL	46																									
	HOK-1		4																														
McCulloch Motors Corp. Aircraft Division 9 7th Airport Blvd., Los Angeles 45, Calif.	MH-4A		2	1 P-G&A 304-C-6	200 @ 3100	200 @ 3100	SL	30	100	SL	90	SL	1000	6000	15,000	200	3000	1450	3.2	11.6	2	3	33'	38.0	440	3	NA	NA	NA	28'	9'	TP
McDonnell Aircraft Corp. St. Louis, Mo.	XH-20*		4	2 Lyc. T-53				80								800	250					1	0							NA	NA	NA	XMO
Penn Chase Co. 201 Hazlewood Ave., Philadelphia 16, Pa.	641		2	1 Ly O-435	150	150	2575	SL	35		65	SL	3000			400	1650	1040	6.0	13.0	0	3.00*	6.00	3,300	3	NA	NA	NA	24'	8'	7'	11'	XMO
Pioneer Helicopter Corp. Marion, Pa.	PD 1-B	H-12B-1	6	1 Lyc. R-975-34	525	2300	500	2500		120	105	SL	80	SL	1200	8000	12,000+	200+	5450	3915	10.7	2	0.53*	1920		0	NA	NA	NA	32'		13+	1P
	PD 1-C	H-12B-2	6																			2	0.53*	1920		0	NA	NA	NA	32'		13+	1P
	PD 1-H	H-12C	6																			2	0.53*	1920		0	NA	NA	NA	32'		13+	1P
	PD 1-K	H-12D	6																			2	0.53*	1920		0	NA	NA	NA	32'		13+	1P
	PD 1-A	H-12E	6	1 Lyc. R-975-34	525	2300	500	2500		120	105	SL	80	SL	1200	8000	12,000+	200+	5450	3915	10.7	2	0.53*	1920		0	NA	NA	NA	32'		13+	1P
	PD 1-G	H-12E-2	6																			2	0.53*	1920		0	NA	NA	NA	32'		13+	1P
	PD 1-D	H-12E-3	6																			2	0.53*	1920		0	NA	NA	NA	32'		13+	1P
	PD 1-E	H-12E-4	6																			2	0.53*	1920		0	NA	NA	NA	32'		13+	1P
Piasecki Helicopter Corp. Morton, Pa.	PV-2	HUP-1	5	1 Lyc. R-975-34	550	2400	340			140	104		82+		1000+	8000+	10,000+	300+	4000+	2750	6.0	2	0.50*	1920		0	NA	NA	NA	32'		13+	1P
	PV-3	HRP-1	10	1 Wright R-1300-3	1,350	2,300	1,100	2,500	5,000	300	110+	SL	100+			17,000+	125,000+	570*	11,330	9,400		2	0.44	3040		0	NA	NA	NA	58'	8'10"	12'	DR
	PV-15	H-21A	22	1 Wright R-1820-103	1,425	2,700	1,275	2,550	5,000	600	110+	SL	120+			14,000+	100,000+	1,000*	13,500	9,500		2	0.44	3040		0	NA	NA	NA	58'	8'10"	12'	DR
	PV-17	H-21B	22	1 Wright R-1820-103	1,425	2,700	1,275	2,550	SL	600	110+	SL	120+			14,000+	100,000+	1,000*	13,500	9,500		2	0.44	3040		0	NA	NA	NA	58'	8'10"	12'	DR

Data in italics are AVIATION WEEK estimates.
* — Approximate.
AHC — American Helicopter Co.
Con. — Continental.
Cur. — Curtiss.
Dsg. — Design study.
Fr. — Franklin (Aircooled Motors).
H — Hiller.
HP — In production.
IS — In service.
Lyc. — Lycoming.
NA — Not applicable.
P&W — Pratt & Whitney.
PD — Production discontinued.
SL — Sea level.
TP — Experimental models only.
XMO — Prototype under construction.

1 Maximum blade tip speed, ft./sec.
2 Service ceiling.
3 Built under contract for Curtiss-Wright as CW-40 now in C-W's possession.
4 Civil version would carry 6 passengers. Tentative price $175,000.
5 Army version is H-25A.
6 Civil versions would carry 11 passengers luxury style, 16 "bus" class or 21 "airliner" class. Tentative price $175,000.
7 LSH versions are HOSS-1 (H-5) HOSS-1 (H-16) HOSS-2 (H-17) and HOSS-3 (H-18). Production licenses granted to Westland Aircraft, Ltd., Ilchester, England, and Sud Aviation, Paris, France. S-58 known as SNOASE, France.
8 MacDonnell received a contract in June 1951 from Navy for a helicopter to be used for training and operational purposes. Company is also working on a jet-powered assault transport copter for Marine Corps.
9 Data given is repeated from Feb. 26, 1951 inventory issue. Sallad did not submit later data.

U. S. Reciprocating Engines

Manufacturer and Address	Model	No. of cylinders	Cylinder arrangement	Cooling system	Propeller drive	Power Ratings: Takeoff hp. (SL)	Power Ratings: At rpm	Power Ratings: Rated hp	Power Ratings: At rpm	Power Ratings: At altitude (ft.)	Octane fuel	Bore and stroke (in.)	Displacement (cu. in.)	Compression ratio	B. M. E. P.	Blower ratio	Guaranteed fuel consumption (lb./hp./hr.)	Maximum oil consumption (lb./hp./hr.)	Cylinder construction	Weights: Gross weight dry without hub or starter	Weights: Pounds per hp. (installed)	Equipment: Make spark plugs supplied with engine	Equipment: Make ignition supplied with engine	Equipment: Make starter supplied with engine	Equipment: Make carburetor supplied with engine
Aircooled Motors, Inc. *Syracuse 8, N. Y.*	4A4-90-B3	4	Ho	A	D			90	2 300	SL	80	4 5⅛ 5	225	7	138		50	.015	Al	2201	2 50	Ch	Ei	Au	MS
	4A4-100-B3	4	Ho	A	D			100	2 550	SL	80	4 5⅛ 5	225	7	138		50	.015	Al	2201	2 20	Ch	Ei	Au	MS
	6A4-150-B3	6	Ho	A	D			150	2 600	SL	80	4 5⅛ 5	335	7	138		50	.015	Al	3201	2 14	Ch	Ei	DR	MS
	6A4-165-B3	6	Ho	A	D			160	2 800	SL	80	4 5⅛ 5	335	7	140		50	.015	Al	3241	1 97	Ch	Se	DR	MS
	6V4-165-B32F[2]	6	Vo	A	D			165	3 000	SL	80	4 5⅛ 5	335	7	138		55	.015	Al	3351	2 16	Ch	Se	DR	Be, MS
	6V4-178-B32	6	Vo	A	D			178	3 000	SL	80	4 5⅛ 5	335	7	140		52	.015	Al	3091	1 73	Ch	Se	DR	Be, MS
	6AG4-185-B12	6	Ho	A	G 632 1			185	3 100	SL	80	4 5⅛ 5	335	7 5	145		51	.015	Al	3491	1 89	Ch	Se	DR	Be, MS
	6V4-200-C32[3]	6	Ve	A	D			200	3 100	SL	91	4 5⅛ 5	335	8 5	152		55	.015	Al	3371	1 69	Au	Se	DR	Be, MS
	6A8-315-B8F	6	Ho	A	R			315	2 500	SL	80	5x4 2	560	7	136		60	.015	Al	447	2 26	Au	Ei Se	Au	MS
	6V8-345-M40F[3]	6	Ve	A	D			345	2 2 5	SL	80	4 7x4	425	7 5	140		52	.015	Al	353	1 46	AC	Ei		Be
Continental Motors Corp. *Muskegon, Mich.*	A65-8F	4	Ho	A	D	65	2 300	65	2 300	SL	73	4 092x3 625	171	6 3	131		50		Al St	182	2 14	Ch	JIC		Be
	C85-12F	4	Ho	A	D	85	2 575	85	2 575	SL	73	4 092x3 625	199	6 3	150		50		Al St	188	2 07	Ch	Se	DR	Be
	C90-12F	4	Ho	A	D	90	2 655	90	2 475	SL	80/80	4 092x3 875	201	7	143		50		Al St	257	2 05	Ch	Se	DR	Be
	C125-2	6	Ho	A	D	125	2 550	125	2 550	SL	73	4 092x3 125	282	6 3	138		50		Al St	265	1 77	Ch	Se	DR	MS
	C145-2	6	Ho	A	D	145	2 700	145	2 700	SL	80/86	4 092x3 875	201	7	141		50		Al St	283	1 75	Ch	Se	DR	MS
	O-315A	4	Ho	A	D	180	2 500	150	2 000	SL	80/86	5x6	316	7	143		50		Al St	383	1 75	Ch	Se	DR	MS
	I-355	6	Ho	A	D	205	2 800	185	2 500	SL	80/86	5x4	471	7	135		60		Al St	385	1 89	BG	Se	Ec	Be
	E225-8	6	Ho	A	D	225	2 655	225	2 250	SL	80/86	5x4	471	7	143		60		Al St	385	1 71	BG	Se	Ec	Be
	O-470A	6	Ho	A	D	225	2-600	225	2 600	SL	80/86	5x4	471	7	142		50		Al St	352	1 56	BG	Se	DR	Me
	W670-33	7	Rad	A	D	240	2 200	240	2 600	SL	80/86	5 125x4 625	666	6 1	150		60		Al St	485	2 12	Ch	Se	Ec	Be
	GE260-2	6	Ho	A	G.69 1	260	3 100	260	3 100	SL	80/86	5x4	471	7			50		Al St	481	1 85	BG	Se	Ec	Be
Diesel Power, Inc.[4] *Pittsburgh, Pa.*		4	Ho	A	D	125	2 500	100	2 400	SL	Diesel	4 875x3 375	800	14					Al St	2485					
Jacobs Aircraft Engine Co. *Pottstown, Pa.*	R-755 B	7	Rad	A	D	295	2 200	275	2 200	SL	80	5 25x5	757	6	131		45	.007	Al St	460		BG	Se	Ec	Be
	R-755-A2	7	Rad	A	D	300	2 200	300	2 200		80	5 25x5	757	6	144		45	.007	Al St	505	1 68	BG	Se	Ec	Be
	R-755-[5]	7	Rad	A	G.649 1	350	2 500	350	2 800	SL	90	6 25x5	757		149		47		Al St	500	1 71	BG	Se	Ec	Be
Lycoming-Spencer division *Avco Mfg. Corp.* *Williamsport, Pa.*	O-145-B2	4	Ho	A	D			65	2 550	SL	73	3 625x3 5	145	6 5	140		51	.010	Al	1M 4	2 54	Ch	Se		MS
	O-235-C1	4	Ho	A	D			108	2 000	SL	80	4 375x3 875	233	6 75	141		52	.012	Al St	2351	2 26	Ch	Se	DR	MS
	O-290-D	4	Ho	A	D			125	2 000	SL	80	4 875x3 875	290	6 5	132		52	.012	Al St	2583	2 06	Ch	Se	DR	MS
	O-290-D2	4	Ho	A	D	140	3 800	135	2 500	SL	80	4 875x3 875	289	7 5	148			.012	Al St	2451	1 75	Ch	Se	DR	MS
	O-435-A	6	Ho	A	D			190	2 550	SL	80	4 875x3 875	434	6 5	150		52	.012	Al St	3021	2 32	Ch	Se	DR	MS
	O-435-A2	6	Ho	A	D			225	3 000	SL	91/98	4 875x3 875	434	7 5	157		51	.014	Al St	3021	1 93	Ch	Se	DR	MS
	O-435-A2	6	Ho	A	G77 120	260	3 400	240	3 000	SL	80/87	4 875x3 875	434	7 3	140		47	.014	Al St	400	1 61	Ch	Se	DR	MS
	GO-435-C2	6	Ho	A	G77 120	260	3 400	240	3 000	SL	80/87	4 875x3 875	434	7 3	140		47	.014	Al St	432	1 80	Ch	Se		Ma
	O-435-E	6	Ho	A	D	260	3 400	240	3 000	SL	80/87	4 875x3 875	434	7 3	140		51	.014	Al St	388	1 63	Op	Se		MS
	O-435-A1	6	Ho	A	D	260	3 400	250	3 200	SL	80/87	4 875x3 875	434	7 3	143		51	.014	Al St	393	1 47	Op	Se		MS
	R-680 13	9	Rad	A	D	285	2 300	280	2 400	SL	91/98	4 625x4 5	380 4	7	150	1	5	.025	Al St	585		Ch	Se		Be
	GSO-435	6	Ho	A	G77 120	300	3 400	240	3 000	7 000	91/98	4 875x3 875	434	7 3	166	7 61	47	.800	Al St	485	1 61		Se		Be
	GSO-580	8	Vo	A	G77 120	375	3 300	320	3 000	7 000	91/98	4 875x3 875	578	7 3	149	7 61	5	.020	Al St	649	1 67	Ae	Se		Be
	GSO-580-C	8	Ve	A	G77 120	375	3 300	320	3 000	7 800	91/98	4 875x3 875	578	7 3	156	7 61	5	.020	Al St	592	1 58	Ae	Se		Be
	GSO-580 B	8	Ho	A	G77 120	400	3 300	350	3 000	5 000	100/130	4 875x3 875	578	7 3	159	7 61	5	.020	Al St	624	1 78	Ae	Se		Be
	GSO-580-H	8	Ho	A	D77 120	400	4 100	350	3 300	5 000	100/130	4 875x3 875	578	7 3	166	7 61	5	.020	Al St	597	1 46	Au	Se		Be

U. S. Reciprocating Engines

Manufacturer and Address	Model	No. of cylinders	Cylinder arrangement	Cooling system	Propeller drive	Power Ratings: Takeoff hp. (SL)	Power Ratings: At rpm	Power Ratings: Rated hp	Power Ratings: At rpm	Power Ratings: At altitude (ft.)	Octane fuel	Bore and stroke (in.)	Displacement (cu. in.)	Compression ratio	B. M. E. P.	Blower ratio	Guaranteed fuel consumption (lb./hp./hr.)	Maximum oil consumption (lb./hp./hr.) @ rated speed	Cylinder construction	Weights: Gross weight dry without hub or starter	Weights: Pounds per hp. (installed)	Equipment: Make spark plugs supplied with engine	Equipment: Make ignition supplied with engine	Equipment: Make starter supplied with engine	Equipment: Make carburetor supplied with engine
Pratt & Whitney Aircraft div. *United Aircraft Corp.* *E. Hartford 8, Conn.*	R-985-[6]	9	Rad	A	D	450	2 800	450	2 800	2 800	80/87	5 18x5 16	985	6	187	10			Al St	682[1]	1 54	Op	Se		Str
	R-1340-S1H1[7]	9	Rad	A	D	500	2 350	550	2 200	5 000	91/98	5 75x5 75	1 344	6	148	12			Al St	805[1]	1 57	Op	Se		Str
	R-1340-S3H1-G[8]	9	Rad	A	G.667 1	500	2 250	550	2 200	5 000	91/98	5 75x5 75	1 344	6	148	10			Al St	865	1 57	Op	Se		Str
	R-1830-S1C3-G	14	Rad	A	G.5625 1	1 200	2 700	1 050	2 550	7 550	91/98	5 5x5 5	1 830	6 7	178	7 15			Al St	1 4671	1 4	Op	Se		Str
	R-2000-D5	14	Rad	A	G 6 1	1 850	2 700	1 200	2 850	6 400	100/130	5 75x6 5	2 004	6 8	187	7 15			Al St	1 5591	1 3	Op	Se		Str
	R-2000-2SD13-G	14	Rad	A	G.61	1 450	2 700	1 200	2 650	5 000	100/130	5 75x5 5	2 004	6 8	187	7 15[9]			Al St	1 5391	1 3	Op	Se		Str
	R-2800-CA18[3]	18	Rad	A	G 450 1	2 800[1]	2 800	1 850	2 800	6 500	100/130	5 75x6	2 804	6 75	185	7 15			Al St	2 3171	1 2	Op	Se		Str
	R-2800-C18	18	Rad	A	G 450 1	2 400[1]	2 800	1 500	2 800	6 500	100/130	5 75x6	2 804	6 75	206	7 29			Al St	2 3571	1 3	Op	Se		Str
	R-2800-CB16[3]	18	Rad	A	G 4M1 1	2 400	2 800	1 800	2 800	6 500	100/130	5 75x6	2 804	6 75		8 4		.025	Al St	2 3191		Op	Se		Str
	R-4360-C52[3]	28	Rad	A	G.575 1	3 800[11]	2 700	2 050	2 850	5 800	105/135	5 75x6	4 363	6 7				.025	Al St	3 370		Op	Se		Str
Wright Aeronautical division *Curtiss-Wright Corp.* *Wood-Ridge, N. J.*	057CTBA1	7	Rad	A	G.5625[1]	800	2 800	700	2 400	5 500	91/98	6 125x5 312	1 508	6 2	188	7 21	.75	.15	Al St	1 055	1 3	Op	Bo	Op	Str
	008C9HB1	9	Rad	A	G 5625 1	1 475	2 800	1 275	2 800	7 500	100/130	6 125x5 875	1 820	6 6	238	7 21	.45	.02	Al St	1 500	.94	Op	Bo	Op	Str
	009C9HE1	9	Rad	A	G 5625 1	1 475	2 800	1 275	2 800	3 500	100/130	6 125x5 875	1 820	6 5	238	7 21	.45	.02	Al St	1 508		Op	Bo	Op	Str
	955C9HE1	9	Rad	A	G 5625 1	1 525[11]	2 800	1 275	2 800	10 000	100/130	6 125x5 875	1 820	6 8	230	7 21[12]	.45	.02	Al St	1 405	.95	Op	Bo	Op	Str
	956C9HE1	9	Rad	A	G 6375 1	1 525	2 800	1 275	2 800	3 500	115/145	6 125x5 875	1 820	6 8	223	7 21[12]	.45	.02	Al St	1 508		Op	Bo	Op	Str
	976C18CA1	18	Rad	A	G 6375 1	2 200	2 900	2 300	2 800	6 700	115/145	6 125x6 3125	3 350	6 8	221	6 48[13]	.45	.02	Al St	2 585	1 00	Op	Se	Op	Str[14]
	978C18CB1	18	Rad	A	G 6375 1	2 300	2 900	2 500	2 800	6 700	115/145	6 125x6 3125	3 350	6 7					Al St	3 065		Op		Op	[15]
	972TC18DA1[16]	18	Rad	A		3 250	2 900				115/145	6 125x6 3125	3 350	6 7					Al St	3 484		Op		Op	[15]

* — Approximate
A — Aircooled
Al — Aluminum and cast iron
Al St — Aluminum, cast iron, steel
Au — Auto-Lite
Be — Bendix
Bo — Bosch
BG — BG Corp.
Ch — Champion
D — Direct drive
DR — Delco-Remy
Ec — Eclipse
Ei — Eisemann
D — Geared
Ho — Horizontally opposed
JIC — J. I. Case
MS — Marvel Schebler
Os — Detleval
Rad — Radial
Se — Scintilla
Sea — Sea level
Str — Stromberg
Ve — Vertically opposed

[1] Weight includes starter and other accessories.
[2] For helicopter installation.
[3] Army version is O-470-7. O-470-11 is similar, rated at 213 hp. take-off at 2,600 rpm. and 150 hp. cruise at 2,100 rpm.
[4] Developed by well-known Diesel engineer Fred A. Thahald; prototype engine is rebuilt conventional gasoline type fitted with new aluminum heads threaded and shrunk to the steel cylinder barrels. Fuel injection is used. Flight tests have been made since July 13, 1951 in a Taylorcraft 16. Fuel consumption of the new engine is given as "not exceeding 3 gal./hr."
[5] Or 91-98 octane, depending on carburetor settings.
[6] R-985-B4 has same performance but is designed to operate with crankshaft in vertical plane.
[7] Developed by well-known Diesel engineer Fred A. Thahald; prototype engine is rebuilt conventional gasoline type fitted with new aluminum heads threaded and shrunk to the steel cylinder barrels. Fuel injection is used. Flight tests have been made since July 13, 1951 in a Taylorcraft 16. Fuel consumption of the new engine is given as "not exceeding 3 gal./hr."
[8] S1H1-D has same performance but has .667:1 prop reduction gearing and dry weight is 653 lb.
[9] S3H1 has Direct Drive same performance, dry weight weighs 865 lb dry. S3H2 has same performance, dry weight is direct drive and is designed to operate with crankshaft in vertical plane.
[10] Low (smaller gear ratio, high is 9.52.
[11] R-2800-CA18 is similar
With water injection
R-2800-CB17 is identical but has higher ratings using 100/135 octane fuel.
[12] R-4360-53 (with fuel injection) fitted to Convair B-36F has 3 500 hp. plus. Later versions deliver more than 4,000 hp.
[13] Or 8.91
[14] Or 8.87.
[15] Direct feed injection.
[16] Turbo-Compound.

U. S. Gas Turbine Engines

Manufacturer and Address	Designation: Manufacturer's	Designation: Military	Type	Stages: Compressor	Stages: Turbine	Turbojets—Performance: Static thrust @ SL (lb.)	Turbojets—Performance: All rpm	Turbojets—Performance: Rated thrust @ SL (lb.)	Turbojets—Performance: All rpm	Turboprops: Shaft hp.	Turboprops: All rpm	Turboprops: Residual thrust (lb.)	Performance: Equivalent shaft hp. @ SL	Propeller reduction gear ratio	Specific fuel consumption lb. hr. lb. thrust or lb. hr. shp	Compressor air mass flow rate @ max. rpm @ SL static (lb. sec.)	Corresponding pressure ratio	Dimensions: Maximum length (in.)	Dimensions: Maximum diameter (in.)	Weight: Total weight with accessories (lb.)	Equipment: Make starter supplied with engine	Equipment: Type starter supplied with engine	Approved overhaul period (hr.)	Remarks
Allison Division *General Motors Corp.* *Indianapolis, Ind.*	400-C13 450-A-23 450-D23 501-A-3 501-D-3 561	J33-A-35 J35-A-29 J35-A-23 XT40-A-1 T38 —	CFJ AEJ AFJ AFW AFT —	1 7 11 11 10 10	1 5 3 3 4 —	8,200 (+) 5,600 (+) 5,200 (+) N. A. N. A. —	N. A. N. A. N. A. N. A. N. A. —	— — — — — —	— — — — — —	N. A. N. A. N. A. — — —	N. A. N. A. N. A. — — —	— — — — — —	N. A. N. A. N. A. 5,925 5,600 —	N. A. N. A. N. A. — — —	N. A. N. A. N. A. .635 — —	N. A. N. A. N. A. — — —	N. A. N. A. N. A. — — —	213 — — 183 169 —	49.2 — — 45* — —	2,465 2,300* 2,190* 2,585 — —	GE GE GE AR AR —	Elec Elec — — — —	500 — — — — —	*Has afterburner* *No afterburner* *Has afterburner* *Turns 25K rpm* *Max. height 50 in.* —
Boeing Airplane Co. *Seattle 14, Washington*	960 502	XT50 —	CFJ CFP	1 1	1 1	410 N. A.	N. A. N. A.	350 —	N. A. N. A.	N. A. 200	N. A. 3,000	N. A. —	N. A. —	N. A. 5.02:1	— —	— —	— —	— 40	— —	1111 300*	— —	Elec, Air Elec, Air	— —	*Turns, combustors elsewhere.* *Failed to Kaman K-225 copter*
Fairchild Engine Division *Wyandanch, Repbic & Airplane Corp.* *Farmingdale, L. I., N. Y.*	—	J44	—	—	—	1,000	—	—	—	N. A.	N. A.	N. A.	N. A.	N. A.	— —	— —	— —	72	22	300*	—	—	—	*Mantle and/or stationary power*
General Electric Co. *Aircraft Gas Turbine Div.* *Lockland, Ohio* *Lynn, Mass.*	7E-TG180-A 7E-TG180-D17 7E-TG180-E —	J47-GE-7 J47-GE-17 J47-GE-23 J53 J73	AEJ AEJ AEJ AFJ AFJ	19 19 13 —	1 1 1 —	8,920 (+) 8,920 (+) 5,400 (+) [4,600 [5,000	? 860 ? 860 —	4 730 — — —	? 830 — — —	N. A. N. A. N. A. 5,800	N. A. N. A. N. A. —	N. A. N. A. N. A. —	N. A. N. A. N. A. —	N. A. N. A. N. A. —	1.08 — — —	N. A. N. A. N. A. —	N. A. N. A. N. A. —	144 222 144 140	68 78 28 78 35 50 28 76	3,900* 3,000* 2,550 —	GE GE GE —	— — — —	800 — 400 —	*Turbo 18, 19, 13 similar* *J47 GE-25, 27 similar* *Diameter is at screen, inductors.* *Under development.* *Formerly designated J47 GE-21*
Pratt & Whitney Aircraft div. *United Aircraft Corp.* *East Hartford, Conn.*	JT3 JT3B JT3D PT3	J57 J67 J48 T34	AEJ CFJ CFJ AFP	16 — — 13	1 1 1 3	[6,000+ [7,500 [8,250+ N. A.	12,500 — — N. A.	4 000 — — N. A.	11 800 — — N. A.	N. A. N. A. N. A. 5,500	N. A. N. A. N. A. —	N. A. N. A. N. A. —	N. A. N. A. N. A. 1111	N. A. N. A. N. A. —	1.06 — — .63	N. A. N. A. N. A. —	N. A. N. A. N. A. —	100 2 100 75 139 —	43 9 36 25 33 —	1 720 2,000* 2,320 —	— — — —	— — — —	1 000 —	*Failed in A-B-C. 1-949.* *Production shared/work.* *Some models with afterburner* *Slated for C-124A, RTO-8 transports*
Westinghouse Electric Corp. *Aviation Gas Turbine div.* *Philadelphia, Pa.*	24C4B 24C4D X40822A	J34-WE-22 J34-WE-34 J46-WE-6	AEJ AFJ AFJ	11 11 —	2 2 —	3,600 3,250 3,500+	12,000 — —	— — —	— — —	N. A. N. A. N. A.	N. A. N. A. N. A.	N. A. N. A. N. A.	N. A. N. A. N. A.	N. A. N. A. N. A.	1.08 — —	N. A. N. A. N. A.	N. A. N. A. N. A.	3.01 — —	120 — —	1 300 1 350 —	Wa — —	Elec — —	— — —	*J34, WE-30 is later model* *CAA approved* *Has afterburner*
Wright Aeronautical Div. *Curtiss-Wright Corp.* *Woodridge, N. J.*	TY-43 —	Y1615-W-1 —	AFP AFJ	19 12	8 9	N. A. 7,000+	N. A. —	N. A. —	N. A. —	15,000 N. A.	15,000 N. A.	— N. A.	14,500 N. A.	N. A. N. A.	.699 .910	— —	— —	— —	79 153	83 83	3,800 2,565	— —	— —	— —	*AE Mantle under license.* *AE-30 propeller/hub under survey*

Data in italics are AVIATION WEEK estimates.
* — Approximate.
AFJ — Axial-flow turbojet.
AFP — Axial-flow turboprop.
AEJ — Axial-flow turbojet.
CFJ — Centrifugal-flow turbojet.
CFP — Centrifugal-flow turboprop.
Elec — Electric.
GE — General Electric.
N. A. — Not applicable.
Na. — Not available.
Wa. — Water-alcohol.
¹ Dry weight without accessories.
² Each engine unit
³ Maximum width

U. S. Personal and Executive Aircraft

Manufacturer and Address	Designation	Powerplant: Number of seats	Powerplant: Number, make and hp. of each engine	Powerplant: Propeller make and diameter (in.)	Performance: Top speed (mph.)	Performance: Cruising speed (mph.)	Performance: Landing speed (mph.)	Performance: Take-off distance (ft.) over 50 ft. obstacle, no wind at gross weight	Performance: Landing distance (ft.) over 50 ft. obstacle, no wind at gross weight	Performance: Initial rate of climb (fpm.)	Performance: Service ceiling (ft.)	Fuel: Maximum range (mi.) fully loaded and with auxiliary tanks	Fuel: Normal fuel capacity (gal.)	Weights: Gross weight (lb.)	Weights: Empty weight (lb.)	Weights: Cargo capacity (lb.)	Dimensions: Span	Dimensions: Length	Dimensions: Height	Dimensions: Wing area (sq. ft.) including ailerons	Standard Equipment: Instruments	Standard Equipment: Radio	Standard Equipment: Starter	Standard Equipment: Position lights	Standard Equipment: Landing lights	Price: Standard price F.A.F.
Aircar, Inc. *Longview, Washington*	Aircar 2[a]	2	1 Ly O-290-D D2 @ 150	H 74	110+	100+	47	1225	700	600+	12 000	500+	24	1800	1250	600	32'	21'	7' 3"	180	1 USG 2 3 ho 4 6 8 5 10 SW 7 AC	No	DR			$15 600
Aero-Flight Aircraft Corp *P O Box 2010* *Long Beach, Calif*	Streak 165	2	1 Fa 6AH 165-93 @ 165[g]		210	210	57	420[a]		2000	25 500	1000[a]	40	1695	1045	50	25' 8"	22' 4"	8' 3"							
Aeronca Mfg. Corp. *Middletown, Ohio*	Champion 7EC	2	1 Con C90-12F @ 90	S-72	110	100	44	900	1842	800		350	18.5	1450	890	220	35' 3"	21' 8"	7'	170	1 4 USG 3 Ap 5 6, 8 SW 7 AC		DR	Gr		$3190
	Sedan 10AC	4	1 Con C145 @ 140	S-74	129	114	53	1000	1000	800		450	36	2050	1150	650	37'	25' 3"	7'	200	1 2 USG 7 AP 5, 6 8 SW AC 90 9F		DR	Ga	GE	$5485
All American Aircraft, Inc. *Long Beach 18, Calif*	Freigh 10A	2	1 Con C85 @ 85	M-71	125	100	55	525	975	700	10 000	400	20	1500	1000	40	33'	21'	8' 6"	130	Flight group Ke engine group SW					$3495
Anderson Greenwood & Co. *Municipal Airport* *Houston, Tex*	AG 14	2	1 Con C90 12J-P @ 90	K 70	120+	110+	52			700+		450	23	1400	850	250	34'	22'	8'	150	1 4 8 2 Ke 4 5 6, 7 8 AC		DR	Gr		$4500[a]
Aquaflight Aircraft Corp. *1001 Harrison Ave* *Wilmington, Dela*	Aqua 2	6	2 Ly O-435-A2 @ 225	H 78	165	155	55	1050		1070	20 800	800	100	4680	3055		36'	28' 6"	12'	217.8						
Baumann Aircraft Corp. *12870 Montague St.* *Pacoima, Calif*	Brigadier 300	6	2 Con C145 @ 140	S-72	155	130	65	1500	800	1250	18 500	750	75	3500	2250		41'	27' 5"	10' 4"	313	30 Rau also 1 2 3 5, 6 7 8, 9 10 14 15 17 23	Le	DR	Ga	Op	$37 500
Beech Aircraft Corp *Wichita, Kans.*	Bonanza C-35	4	1 Con F185-11 @ 205	S-88	190	175	55	1000	700	1100	18 000	800	30	2700	1647	270	33' 10"	25' 2"	6' 7"	177.6						$16 950
Call Aircraft Co *Alton E Wyn*	Caliar A-2	2-3	1 Ly O-360-3 @ 125	M	120	105	45*			1000	17 400	455	37	1550	975		35' 10"	24' 5"	7'	191.6	28 SF		Ec	Ga	Gr	$4899
Cessna Aircraft Co. *Wichita, Kans*	170[f]	4	1 Con C145-2 @ 145	M-76	140+	120+	52	1625	1145	690	14 200	490+	42	2200	1210	190	36	25	8' 5"	174	1 2, 3 4 5 6 7 8, 10					$7245
	190	4-5	1 Con W-670-23 @ 240	HS-93	170	160+	63	1070	1405	1090	16 000	700+	81	3350	1915	220	36	27' 1"	7' 1"	208	1 1, 2, 3 4 5 6, 8 9, 10 13 14 18 18, 20 21		Ec	Ga	Gr	$10 500
	195	4-5	1 Jac R 755-13 @ 300	MS-93	180+	165+	63	1000	1405	1260	18 000	750+	81	3350	2050	220	36	27'	8' 7"	216	1 Same as 190		Ec	Ga	Gr	$11 750
	195A (LI 120)	4-5	1 Jac R 755-B @ 245	HS-93	172	160+	60	1370	1495	840	13 800	700	81	3350	2050	220	36	27'	8' 7"	208	1 Same as 190		Ec	Ga	Gr	$12 995[a]
Continental Inc. *Danbury, Conn*	Amph ban FA-8	2	1 Fr-Ghent @ 165[g]	S-72	125	110	54	1600	1650	700	18 500	385	30	2100	1300	90	38' 6"	22' 5"	7' 8"	170.6	1, 2 Ko; engine group AC 8 Sch 16, 19 AC 19 Le	Na	DR	Ga	GE	
Dauby Equipment Co Inc. *21 Hyde Park Blvd* *Los Angeles 47, Calif*	St Navion (N-48)[f]	4	2 Ly O-290-D @ 135	S-74									39	2950	1015	165										
Fnak Aircraft Co *Coffeyville, Kans.*	B-85C	2	1 Con C85 C90 @ 85	Lew 72	110	100	40	400	400	800		400		1350	890		35	20	7' 0"	147			DR	Gr		$3900[a]
T P Hall Engineering Corp. *411 Sprecklels Bldg* *San Diego, Calif*	Flying Auto HEP	4	1 Ly O-435 @ 190	78	130	125	61			645	11 000	400	30	2550	1484	120	34'	27' 3"	8' 4"	188	Op	Op	Op	Op	Op	

AVIATION WEEK, February 25, 1952

U. S. Personal and Executive Aircraft

Manufacturer and Address	Designation	Powerplant: Number of seats	Powerplant: Number, make and hp. of each engine	Powerplant: Propeller make and diameter (in.)	Performance: Top speed (mph.)	Performance: Cruising speed (mph.)	Performance: Landing speed (mph.)	Performance: Take-off distance (ft.) over 50 ft. obstacle, no wind at gross weight	Performance: Landing distance (ft.) over 50 ft. obstacle, no wind at gross weight	Performance: Initial rate of climb (fpm.)	Performance: Service ceiling (ft.)	Performance: Maximum range (mi.) fully loaded and with auxiliary tanks	Fuel: Normal fuel capacity (gal.)	Weights: Gross weight (lb.)	Weights: Empty weight (lb.)	Weights: Cargo capacity (lb.)	Dimensions: Span	Dimensions: Length	Dimensions: Height	Dimensions: Wing area (sq. ft.) including ailerons	Standard Equipment: Instruments	Standard Equipment: Radio	Standard Equipment: Starter	Standard Equipment: Position lights	Standard Equipment: Landing lights	Price: Standard price, F.A.F.
Helio Aircraft Corp. *Norwood, Mass.*	Courier H-391	4	1 Ly GO-435-C2 @ 260	H-101	160*		90*						90	3000	1800		39'		8' 10"	231	1, 2, 3, 4, 5, 6, 7, 8 11	Op	Op	Op	Op	
Jamieson Aircraft Co Inc. *Akron, Ohio*	J-2-11	3	1 Ly O-235-C1 @ 115	S-74	100	145	50*			1050*	17 500*	700*	20	1500	890		26'	20' 10"	8' 2"	123.2	Engine group SW 1, 2 3		DR	Gr	GE	
Lanier Aircraft Corp. *Marlton Medford Airport* *Marlton, N.J.*	Parapione 2	2	1 Con C90 @ 90[g]		124	105	30	800*	250*	1225							20' 8"	22'	0 4"	167						
Mayum Aircraft Co. *Tecumseh, Mich*	145	2	1 Con C145-2F @ 140	M 74	167	152	45			950	18 800	550	38	1810	1300	125	30'	21' 10"	6	154	1 2 3 4 5, 6, 8 11, 12, 16		DR	Gr	GE	$8495
Mooney Aircraft, Inc. *Airport Box 3012* *Wichita, Kans*	M 18C	1	1 Con A65-8 12 @ 65	FI-00	142	130	43	1000	800	1090	19 800	400	12	980	525	75	26' 10"	17' 8"	6' 3"	95	1 2 4 5, 6 7	Op				$5511
	M 18LA	1	1 Ly O-145-B2 @ 65	S-60	158	125	43	1000	800	1090	19 500	400	12	850	525	75	26' 10"	17' 8"	6' 3"	95	1 2 3 5, 6 7	Op				$5519
Personal Aircraft Research Center *Texas A&M College System* *College Station, Tex*	Ag-1	1	1 Lea L225-104 @ 225	L-90	115	100	45	1300		800	12 000	400	48	3400	1800	1200	39' 10"	28' 8"	8' 7"	380						
Pines Aircraft Corp *Lock Haven, Pa*	Super Cub PA 18?	2	1 Ly O-290-D @ 125	S-74	125	110	40	500	500	1050	11 100	260	18	1500	875	90	35'	22' 4"	6' 8"	178.0	1 2 Am 3 Ap 5, 6 USG 7 SW		DR	Ga		$4995
	Super PA 20	4	1 Ly O-290-D @ 125	S-74	140	120	45	1 88	1187	810	15 500	580	36	1800	1000	400	29'	24' 10"	8' 3"	147.0	1 2 Am 3 Ap 5, 6 12 USG 7 SW		DR	Ga		$5875
	Tri-Pacer PA-22	4	1 Ly O-290 D @ 125	S-74	133	118	48	1785	1187	810	15 500	580	36	1800	1000	400	29'	24' 10"	8' 3"	147.0	Same as PA-20		DR	Ga		$5345
Ryan Aeronautical Corp. *Lindbergh Field* *San Diego 12, Calif*	Navion Super 9000[h]	4	1 Ly GO-435-C2 @ 290	H-90	174	170	55	770	875	1300	18 000	900	90	3850	1930	550	33' 6"	27' 0"	8' 8"	175	1 10 USG 2 Kw 3 Ap 4 kS 5, 6, 8 11 SW 9 Sch 10 L 13 Sa 14 AN 5825-1 16 AC 18 El	RCA	Ea			$14 975
Taylorcraft, Inc. *Conneaut, Pa*	Sportsman 10	2	1 Con C85 12F @ 90	S-72	115	105	50			500	17 000	400	18	1500	855	72	36	22	8	156			DR	Gr		$3895
	Tourist	4	1 Con C145-2 @ 145	S-54	125	115	55			700	17 800	540	40	2200	1250	38	36	24	7'	180.3			DR	Gr		$5950

— — Approximate.
AC — A.C Instrument Co
Am — Ammarine.
Ap — Airpath.
E — Esech.
Con — Continental.
DR — Delco-Remy
Ec — Enjiana
El — Elgin.
Fi — Fleiliep.
Fa — Franklin (Air Cooled Motors)
GE — General Electric.
Ga — Grimes.
H — Horizell
HS — Hamilton Standard.
Jas — Jacobs.
K — Kanaris.
Ko — Kollsman.
KS — King-Seeley
Le — Lear.
Lewis — Lewis Engrg. Co
Lew — Lewis (prose)
Lo — Longine
Ly — Lycoming
M — McCauley
No — Narco.
Oe — Optional
RCA — Radio Corp. of America.
S — Sensenich.
Sa — Scott.
Sch — Schwien.
SF — Safe Flight
SW — Stewart-Warner
USG — U. S. Gauge

Instrument Code

1 Airspeed, 2 altimeter, 3 compass, 4—fuel quantity 5—oil pressure 6 oil temperature 7 tachometer 8—ammeter 9 turn and bank, 10 cylinder head temperature, 11—fuel pressure 12 manifold pressure, 13 outside air temperature, 14 rate of climb, 15 suction gage 16—recording tachometer 17 voltmeter 18 clock, 19 accumulator with odometer 20—stall warning indicator, 21—carburetor air temperature 22 —hydraulic pressure.

[a] Numerals indicate type of instrument (see instrument code); letters indicate maker—see preceding columns.
[b] Flying autowheels.
[c] Combines oil pump.
[d] De Luxe.
[e] Price is with customer-furnished engine.
[f] North American-built Navion Ouing modified to handle flight tests of Plastic & Rubber Products Inc. aviation O rings. Performance awaits flight tests.
[g] Army version is L-21. Also available with 90-hp. Continental engine (Army version is L-16). PA 18-A has Piper dust spray equipment installed.
[h] Production suspended during emergency
[i] Engine modified by Continental Inc.

U. S. Civil and Military Transport Aircraft

Manufacturer and Address	Designation	Name	Seating: Number of crew	Seating: Number of passengers	Cargo Capacity: Cubic feet	Cargo Capacity: Pounds	Powerplants: Number, make and model	Takeoff power (SL) hp., lb. thrust, or shp.	Normal rated power, hp., lb. thrust, or shp.	At altitude (ft.)
Aero Design & Engineering Co. *Box 118 Bethany Okla.*	520	Aero Commander	2	4-5			2 Ly GO-435-C2	480	240	
Beech Aircraft Corp. *Wichita, Kans.*	D18S	Twin Beech	2	6		500	2 P&W R-985	450	450	5 000
	50	Twin Bonanza	1	5	55	800	2 Ly GO-435-C2	260	240	SL
Boeing Airplane Co. *Seattle Washington*	377	Stratocruiser	8-9	50-75			4 P&W R-4360	3 500	2 650	
	C-97A	Stratofreighter	5	130			4 P&W R-4360-35	3 500	2 650	
Chase Aircraft Co., Inc. *W Trenton, N J*	YC-122C	Avitruc	2	36	1 690	8 000	2 Wr R-1820-101	1 425	1,275	3 000
	XC-123A	Avitruc	2	60	3 000	16 000	4 GE J47-GE-11	5 200	5 100	SL
	C-123B	Avitruc	2	60+	3 600	16 000	2 P&W R-2800-83W	2 500	1 900	7 000
Consolidated Vultee Aircraft Corp *San Diego, Calif*	240	Convair-Liner	3-4	40	320		2 P&W R-2800-CA18	2,400	1 800	6 000
		Turboliner					2 All T-38	2,750		
	340	Convair-Liner	3-4	44	617		2 P&W R-2800-CB16	2,400	1 800	8 000
Douglas Aircraft Co. Inc. *3000 Ocean Park Blvd. Santa Monica, Calif*	DC-6A-1135A	Liftmaster	3		5 050	30 750	4 P&W R-2800-CB17	2,500	1 800	8 700
	DC-6B-1225A[3]		5	60	544	11 530	4 P&W R-2800-CB16	2 400	1 800	5 700
	DC-6B-1198A[4]		5	54	534	11 730	4 P&W R-2800-CB17	2 500	1 800	8 700
	DC-7		5	60-95			4 Wr 972TC18DA1	3 250		
	R4D-8		2	35	1 490	10 500	2 Wr R-1820-80	1 475	1 225	3 100
	R6D-1	Liftmaster	5		6 000	26 450	4 P&W R-2800-52W	2 500	1 800	6 800
	C-124A	Globemaster 2	5	200	10 000	50 000	4 P&W R-4360-20W	3,500	2 650	9 000
	YC-124B	Globemaster	5				4 P&W YT34-P-1	5 600		
Fairchild E&A Corp. *Aircraft division Hagerstown Md.*	C-119C[9]	Packet	5	64	2,200	10 000	2 P&W R-4360-20WA	3,250	2 650	6 000
	XC-120	Pack Plane	5	60	2 700	20,000	2 P&W R-4360-20WA	3 250	2 650	6 000
Lockheed Aircraft Corp *Burbank, Calif*	1049-53	Super Constellation	11	63	850	12 300	4 Wr C18CA1	2,700		
	1049B-55	Super Constellation	3-11	106	5 569	31 500	4 Wr 972TC18DA1	3,250		
	1049C-55	Super Constellation	3-11	47-99	830	12,500	4 Wr 972TC18DA1	3,250		
	XR6O-1	Constitution	12	168	6 370	34,100	4 P&W R-4360-22W	3,500	2 500	5 500
Glenn L. Martin Co. *Baltimore 3 Md.*	2-0-2		3	36	340		2 P&W R-2800-CA18	2,400	1 800	5 500
	2-0-2A		3	36			2 P&W R-2800-CB16	2 400	1 800	
	4-0-4		3-4	40	316	8 100	2 P&W R-2800-CB16	2 400	1 800	6 500

Designation	Top speed (mph.)	At altitude (ft.)	Cruising speed (mph.)	At altitude (ft.)	Takeoff distance (SL) no wind at gross wt. over 50 ft. obstacle	Landing distance over 50 ft. obstacle (ft.)	Initial climb at gross wt. (fpm.)	Initial climb at gross wt. with one engine dead (fpm.)	Normal range (mi.)	Fuel: Normal fuel capacity (gal.)	Gross weight (lb.)	Empty weight (lb.)	Span	Length	Height	Wing area (sq ft.) including ailerons
520	211	SL	185	SL	850	900	1 500		1,150	150	5 400	3 500	44'	34'	13' 6"	242
D18S	230	5 000	211	10 000	1 760	1 460	1,100		1,120	205	8 750	5 770	47' 7"	33' 11"	9' 2"	349
50	200	2 500	180	15 000	1 346	1 313	1 500		1 155	134	5 000	3,800	45' 4"	31' 6"	11' 4"	277
377	375	25 000	340	25 000	5 400	5 640	1 100	560		7 790	145,800	83 500	141' 3"	110' 4"	38' 3"	1 769
C-97A	375		300+						2 300	7 735	145 800	82 500	141' 3"	110' 4"	38' 3"	1 769
YC-122C	204	11 600	172	10 000	1 350	690	1 280	180	1,150	664	32,750	20,100	95' 8"	61' 8"	24' 8"	912.8
XC-123A													95'	77' 1"	32' 6"	1,104
C-123B	245	14 600	215	10 000	2 200	1 650	1 380	205	1 000	1 462	52 600	28,300	110'	76' 3"	34' 1"	1,223
240	347	16 000	272	17 000	2 700	2 385	1 520		1 160	1 000	41 790	27,682	91' 9"	74' 8"	26' 11"	817
(Turboliner)			316							1 550	41 790		91' 9"	74' 8"		817
340	330	14 500	284	18 000	4 920[2]	4 250[2]	1 310		866	1 750	46 000	29 486	105' 4"	79' 2"	28' 2"	920
DC-6A-1135A	371	16 300	315	22 400	4 450	3 100	985	320	4 000	5 525	107 000	52 311	117' 6"	106' 8"	28' 8"	1 463
DC-6B-1225A[3]	371	20 600	315	22 400	3 615	2 905	1 035	550	3 210	4 722	102 000	60 990	117' 6"	106' 8"	28' 8"	1 463
DC-6B-1198A[4]	371	19 300	315	22 400	4 450	3 100	900	520	4 020	5 525	107 000	58 340	117' 6"	106' 8"	28' 8"	1 463
DC-7	400+	22 000	306	24 700	5 870[5]	5 300[6]	1 260		6,625	4 500	116 800[7]		117' 6"	108' 11"	28' 7"	1 463
R4D-8	270	5 800	215	10 000	900	1 420	1 060	272	2,750	1,622	31 000	20 410	90'	67' 10"	18' 10"	969
R6D-1										5 400	103 000	54 567	117' 6"	106' 8"	28' 8"	1 463
C-124A	300+								6 850[8]	11 000	175 000	96 000	173' 3"	127' 1"	48' 3"	2,510
YC-124B	400										200 000		178'	127'	48'	2 500
C-119C[9]	281	18 000			2 300	1 830	1 510		800	2 700	74 000	40,000	109' 4"	86' 6"	26' 8"	1 447
XC-120	250+								1,500		70 000		109' 4"	83'	24' 11"	1 447
1049-53	333	17 700	270	21,500	6 200	3 180	1,185	395	2 380	6 550	120 000	58,200	123'	113' 7"	24' 9"	1 650
1049B-55	364	20 000	300	22,600	4 320	3 540	1 115	560	2 200	6 550	130 000	62 050	123'	113' 7"	24' 9"	1 650
1049C-55	364	20 000	330	22,500	4 600	3 410	1 195	540	2 500	6 550	130 000	69 154	123'	113' 7"	24' 9"	1 650
XR6O-1	300+	20 000	250+	25 000	4 000*	2 900*	700+		4 000+	9 100	184 000	114 575	189' 1"	156' 1"	50' 5"	3 610
2-0-2	311	14 000	286	10 000	1 565	1 720	1,270	400	1 390	1 350	42 750	26 211	93' 3"	71' 4"	28' 5"	864
2-0-2A	310	16 200	270	18 000	1 580	2 220	1 385	383	1 135	1 350	43 000	27 064	93' 3"	71' 4"	28' 5"	864
4-0-4	310	14 500	280	16 000	1 590	1 780	1,905	400	1 000	1 350	43 650	28 126	93' 3"	74' 7"	28' 5"	864

Data in italics are AVIATION WEEK estimates.
- * — Approximate
- All — Allison Division General Motors
- GE — General Electric
- Ly — Lycoming
- P&W — Pratt & Whitney
- SL — Sea level
- Wr — Wright

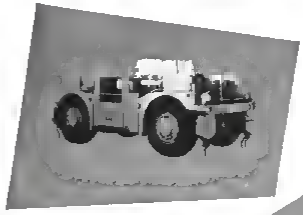
[1] 1 600 hp. is maximum continuous power.
[2] Required CAR runway length
[3] Overwater airplane.
[4] Domestic airplane.
[5] Takeoff on CAR field length at 105,000 lb.
[6] Landing on CAR field length at 85,000 lb.
[7] Overseas version will have 122,200 lb. takeoff weight and carry 6,600 gal fuel.
[8] Ferry range.
[9] Latest production version (C-119H) has Wright R-3350-85 Turbo-Compound engines, numerous detail changes.
[10] USAF version this model is C-121C. Navy model is R7O-1. USN's R7O2O will have four P&W T34 turboprops.
[11] Lower deck capacity

HERE'S PART OF *what it takes*

(1) S-600 Janitrol heater for wing tip pods of new Douglas C-124A, also the heart of the F-4 portable ground heater, with radiant tube providing twice the heat in half the space. **(2) S-800** on DC-6, DC-6A, DC-6B, and new DC-7, features low ventilating air pressure drop, dual ignition. **(3) S-125,** now used in C-124, Constellation 649. **(4) S-100,** workhorse of the Janitrol line in the last war, on DC-4, C-46, C-54, JD-1, Grumman Mallard T-28, C-124, new Constellations. **(5) S-200,** in use on C-119, C-120, and Super DC-3, is adaptable to jet fuel operations. **(6) S-50** serves variety of uses on C-125, F4U-5, F7F-3, F-51, SB2C. **(7) S-25,** weighs only 12 lbs., used in Navy fighters for gun heating. **(8) V-15,** mighty midget, weighs 6 lbs., fits practically anywhere for heating cockpit, guns, instruments, windshield, etc. **(9) F-4,** 400,000 Btu/hour Janitrol portable heater, ideal for ground comfortization of aircraft, engine preheating, instant heat for semi-enclosed work areas, shelter heating, parachute drying, ventilation in summer. **(10) T-20,** house trailer heater. **(11) Janitrol liquid heater** (gasoline or oil fired) for pre-warming, starting, or standby heat with diesel or other engines on vehicles or stationary applications. Proven in 5 years of service on diesel coaches, now serving many special vehicles.

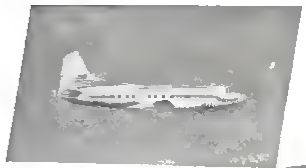
AIRCRAFT AUTOMOTIVE DIVISION • SURFACE COMBUSTION CORPORATION • TOLEDO 1, OHIO • U. S. A.

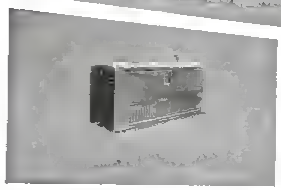
F. H. Scott, 225 Broadway, New York, N. Y. • C. B. Anderson, 2201 Grand Ave., Kansas City, Mo. • L. A. Curtin, 7046 Hollywood Blvd., Hollywood, Calif. • F. H. Scott, 4650 East West Highway, Washington, D. C. • Phil A. Miller, Frank Beck, USAF Coordinator, Central District Office, 400 Dublin Ave., Columbus, Ohio • Headquarters, Toledo, Ohio



TO PUT *heat* WHEREVER YOU WANT IT

Whenever a hot aircraft story breaks, chances are that Janitrol is in the picture. For one thing, Janitrol makes a complete line for commercial and military aircraft, ground vehicles and stationary engines. Janitrol portable heaters, now serving in scores of applications for engine warmup, shelter heating, etc., incorporate the same time-proven dependability of Janitrol aircraft heaters. And rounding out the line are Janitrol liquid heaters, whose performance on tow tugs, fire fighting crash trucks, fuel trucks, and diesel transit coaches points to new applications on a wide range of diesel or gasoline engine powered equipment. Whether you build, operate, or maintain equipment that calls for heat, call in your nearest Janitrol representative. He's a good man to know.





Janitrol

HEATERS WITH THE WHIRLING FLAME

Foreign Military and Civil Aircraft

Manufacturer and Address	Designation	Category	Seats: No. of crew	Seats: No. of passengers	Powerplant: Number, make and model of engines	Powerplant: Take-off power (SL) lb. thrust, or shp.	Powerplant: Normal rated power lb. thrust, or shp.	Powerplant: At altitude (ft.)	Performance: Top speed (mph.)	Performance: Cruising speed (mph.)	Performance: Initial rate of climb (fpm.)	Performance: No wind, SL, take-off over 50 ft. obstacle (ft.)	Performance: No wind, SL, landing over 50 ft. obstacle (ft.)	Performance: Normal range (mi.)	Fuel: Normal fuel capacity (gal.)	Weights: Gross weight (lb.)	Weights: Empty weight (lb.)	Dimensions: Span	Dimensions: Length	Dimensions: Height	Dimensions: Wing area, including ailerons (sq. ft.)	Remarks
AUSTRALIA																						
Commonwealth Aircraft Corp *Lauraer St, Port Melbourne*	CA22	Trainer	2	3	1 P&W R 985-AN 2	445	415	5 400	181	164	1 000	1 200	1 500		73	3 500	3 015	35' 5"	29' 8"	8' 3"	250	Stated first Commonwealth-designed 450-hp Cirrus 7-cyl radial engine
de Havilland Aircraft Pty., Ltd. *Bankstown, N. S. W.*	DHA-3	Drover	1 7	14	3 DH Gipsy Major 10-2	145	110	6 000	158	140	855	1 360	1 680	850	96	6 500	4 250	64'	36' 8"	16'	326	Fixed landing gear
CANADA																						
Canadair Ltd *Montreal P Q*	C-4	Argonaut	2 40		4 R R Merlin Mk 626-1	1 735			333	327		5 200	4 600	3 850*	3 871	86 200	47 316	117 6"	93 7"	27 6"	1 457	6 420 lb cargo capacity
	C-5	North Star	3-33		4 P&W R-2000-CA16	2 100	1 500	6 000	356	318		4 590	5 050	3 540	3 871	86 000	49 475	117 6"	93 11"	39	1 457	5 194 lb. cargo capacity
de Havilland Aircraft of Canada Ltd. *Postal Station L Toronto Ont.*	DHC-1	Chipmunk	2		1 DH Gipsy Major 10B	145	138	SL	140	124	800	870	930	485	30	1 930	1 184	34 4"	25' 6"	7	179 5	Also produced by parent firm
	DHC-2	Beaver	1 7		1 P&W R-985-AN-6B	450	400	5 000	176	153	1 220	775	775	690	88	4 820	2 516	48	30' 3"	10 7"	250	USAF version is L-20
	DHC-3	Otter	1 8-14		1 P&W R-1340-AN 2	600	550	6 000	172	145	1 080	1 000	1 100	1 100	238	7 200	4 000	58'	42'	16 6"	407 4	Beaver 9 evelopment
Found Bros. Aviation Ltd. *Mallon Airport, Toronto Ont*	FBA-2	Personal	4		1 DH Gipsy Major 1-C	140									45 4	2 200	1 325	26	24	8" 9"	188	90.4 cu. ft. cargo capacity
A. V. Roe (Canada) Ltd. *Malton Ont.*	CF-100	Canuck	AW Fighter	2	2 AvC Orenda	7 000*			600+							52		53	67' 10" 7"			4 20-mm cannon
	C-102	Jetliner	Transport	2-40-60	4 R-R Derwent 5/17	3 000	3 000	SL	472	485	2 760	3 600	3 100	1 300	2 834	86,000	57 000	88'	82' 10"	26' 6"	1 157	Production at present unlikely
ENGLAND																						
Sir W G. Armstrong Whitworth Aircraft Ltd.		Meteor N F 11	AW Fighter	2	2 R R Derwent											43		48' 6"	13' 6"		374	Development by AW of Meteor Mk 8.
Bagington Air Coventry	AW65	Apollo	Transport	3-4-26-41	4 AS Mamba ASM3	1 3-0			216	1 480			1,000		1 186	45,000	29 000	92	71 6"	20'	686	10 11.-lbs. DB preps
Auster Aircraft Ltd. *Rearsby Aerodrome, Leicester*	J.1B	Aiglet	Personal	3-4	1 DH Gipsy Major 1	130	120	SL	126	105	710	1 145	1 230	345	18	2 000	1,215	28'	23' 3"	8' 6"	185	Service ceiling 15,000 ft
	J.5		Personal	3	1 DH Gipsy Major 1	130	120	SL	110	76	465	1 000	1 900	355	26	2 150	1,162	39'	23	8' 9"	185	Takeoff landing runs with 5 mph wind.
	J.5B	Autocar	Personal	4	1 DH Gipsy Major 1	130	120	SL	117	100	535	1 345	1,470	500	36	2 800	1,413	36'	23	9" 6"	185	Service ceiling 11,000 ft.
	J.5F	Aiglet Trainer	Personal	2-4	1 DH Gipsy Major 1	130	120	SL	123	112	710	1 520	1 170	370	18	2 200	1,323	32	23	9" 5"	185	Acrobatic taurus versions.
	Q	Auster Mk. 7	Trainer	3	1 DH Gipsy Major 7	145	142	SL	122	107	600	900	1 302	350	28	2 122	1,469	36'	23' 6"	8' 8"	185	Takeoff run with 5 mph wind.
	S		Liaison	2	1 31 Cirrus Bombardier	130	125	1,250		117	990	720	730	230	28	2 025	1 496	36'			185	Service ceiling 16,000 ft.
	S.4	Ambulance/Freighter	Utility	1-3	1 31 Cirrus Bombardier	180				105	705	1 245	765	300		2 500		37'	24 6"	8' 5"	189 7	Takeoff landing runs with 5 mph wind
Blackburn & General Aircraft Ltd *Brough, E. Yorkshire*	G.A L.60	Universal Freighter	Transport	4 60	4 Br Hercules 730	2 615	1 8 0	6 000	238	180	700	3 360	2 700	1 615	8,500	10" 500	52,636	162	86	33'	2 916	34,535 lb cargo capacity
Scottish Paid Aircraft Ltd *Wolverhampton*	P 108A	Ballad T.2	Trainer	2	1 R-R Merlin 35	1 480	1 240	5 000	292	270	1 720	1 850	1 250	870	160	8 416	6 730	39' 4"	36 1"	12' 9"	250	Naval version is Sea Ballad T 21
	P 111		Research	1	1 R E Nene													33 8"	26 1"	12' 6"		Delta-wing research
Bristol Aeroplane Co., Ltd. *Filton House, Bristol*	167	Brabazon 1 Mk. 2	Transport	15 105	4 Br Coupled Proteus 750	8 440	2 500	25 000	300	345	1,400	4 575	4 700	5 500	18 100	300 000*	154 500*	230'	178' 10"	50' 8"	5 422	1,500 cu. ft. cargo capacity
	170	Freighter Mk 31	Transport	3 48	2 Br Hercules 734	2 000	1 580	4 500	230	158	1 200	2 330	2 750	1,500	1 405	42 600	26,735	108'	68' 4"	28' 4"	1 487	14,220 lb. cargo capacity
	176	Britannia	Transport	4 50-104	4 Br Proteus	3 320	1 280	3 500	420	367	1,750	3 500	3 100	4,000	8 900	140 000	71,000	140'	114	36	2 055	370 cu ft cargo capacity

Manufacturer and Address	Designation	Category	Seats: No. of crew	Seats: No. of passengers	Powerplant: Number, make and model of engines	Powerplant: Take-off power (SL) lb. thrust, or shp.	Powerplant: Normal rated power, lbs. thrust, or shp.	Powerplant: At altitude (ft.)	Performance: Top speed (mph.)	Performance: Cruising speed (mph.)	Performance: Initial rate of climb (fpm.)	Performance: No wind, SL, take-off over 50 ft. obstacle (ft.)	Performance: No wind, SL, landing over 50 ft. obstacle (ft.)	Performance: Normal range (mi.)	Fuel: Normal fuel capacity (gal.)	Weights: Gross weight (lb.)	Weights: Empty weight (lb.)	Dimensions: Span	Dimensions: Length	Dimensions: Height	Dimensions: Wing area, including ailerons (sq. ft.)	Remarks
de Havilland Aircraft Co., Ltd *Hatfield Hertfordshire*	DH106	Vampire F.B.5	Fighter	1	1 DH Goblin 3	3,360	3,450	30 000	560	520	6 000	3 400	5,000	1 320	330	12 350	7 280	35'	30' 6"	8' 2"	262	Ordered/purchased by 14 Air Forces.
	DH104	Dove	Transport	2 8-11	2 DH Gipsy Queen 70	540	330	5,000	210	178	850	2 870	2 250	890	202	8,500	5 657	57'	39' 6"	13 4"	333	800 lb. cargo capacity
	DH106	Comet Series 1	Transport	4 44	4 DH Ghost 50	5 000	4 300	SL	500*				1 750	4 000	8 400	110,000		115'	96	28'	2,015	14,000 lb. cargo capacity
	DH106	Comet Series 2	Transport	4 44	4 R-R Avon	6 500+			500				2 900	4 000	8 493			115	93'	28'	2,015	14,000 lb. cargo capacity
	DH113	Vixen N F.2	AW Fighter	2	1 DH Ghost	6 000*			600*									41 10"	31 11"			Vampire development
	DH112	Sea Vixen	AW Fighter	2	1 DH Ghost	6 000*			600*									41 0"	38' 3"	8' 9"		Carrier-based
	DH114	Heron	Transport	2-14 17	4 DH Gipsy Queen 30-2	550	250	SL	178	165	1 125	2 555	1 995	880	245	12 500	8 985	71 6"	48' 6"	14 3"	499	1 150 lb. cargo capacity
	DHC-1	Chipmunk	Trainer	2	1 DH Gipsy Major 8	145	142	SL	138	110	900	850	900	202	20	2 000	1 41"	24 4"	23' 8"	7' 1"	173 5	Service ceiling 19,000 ft.
(Airspeed Division) *Christchurch*	AS-57	Ambassador	Transport	3 41 42	2 Br Centaurus 661	3 650	2 270	6 000	300	272	1 500	3 030	2 450	1 000	1 900	38 500	35 751	115'	81	18' 4"	1 500	11 000 lb. cargo capacity
	DH115	Vampire T 11	Trainer	2	1 DH Goblin 3	3 350	2 950	SL	545	350	4 600	2 485	3 495	1 300	396	11 030	7 500	38'	34 8"	7'	262	Service ceiling 40,000 ft
English Electric Co. Ltd. *Queens House, London*		Canberra B.2	Bomber	3	2 R-R Avon	6,500+			600*									64'	65 6"	15' 7"	960	Four firms in Britain will build
		Canberra P R.3	Photo	2	2 R R Avon	6,500+			600*									64	66 8"	15' 7"	960	High-altitude reconnaissance
Fairey Aviation Co. Ltd. *24 Brutton St., London, W 1*	F D 1		Research	1	1 R-R Derwent	3-500												19 7"	26' 3"			Delta-wing research
		Firefly A S"	ASW	3	1 R R Griffon				320+									44' 6"	37' 11"	14' 4"	328	Interim type until Gannet.
		Gannet	ASW	3	1 AS Double Mamba	2 646			300*									54 4"	43"	13 9"		Retractable radome
Gloster Aircraft Co. Ltd. *Hucclecote Gloucester*		Meteor T 7	Trainer	2	2 R R Derwent 8	3,500			598		7 100	2 350	2 300	800	396	14 140	10 548	37	44'	13	350	Service ceiling 36 000 ft
		Meteor F.8	Fighter	1	2 R R Derwent 8	3,500			598		7 600	2 400	2 300	710	496	15,350	10,540	37	45	14	350	Service ceiling 45,000 ft
		Meteor F.R.9	Fighter	1	2 R R Derwent 8	3,500			598		7 600	2 400	2 700	617	458	15,770	10,790	37	45	14	350	Has guns and cameras
		Meteor P R III	Photo	1	2 R R Derwent 8	3,500			576		7 100	3 300	2 600	730	493	15 600	10 593	43'	44	13	374	Cameras only—no guns. Delta-wing interceptors
	G A.5		Fighter	1 2	2 AS Sapphire	7 200+			550+													
Handley Page Ltd *Cricklewood London*	H P 67	Hastings 2	Transport	5 50	4 Br Hercules 106	1,676	1 475	8 000	340	316	865	4 758	4 200	1 571	3 672	90,000	48 427	113'	61 8"	27' 6"	1,408	Troop transport.
	H P 81	Hermes 4	Transport	5-74	4 Br Hercules 763	2,100	1 675	5,750	352	291	975	4 080		1 937	3 842	85,000	51 655	113'	86 10"	30	1,408	17,000 lb. cargo capacity
	H.P.82	Hermes 5	Transport	5-74	4 Br Theseus	2 400	2 400	SL	365	352	2 380	3 235	3,720	2 025	4 214	90,000	49 228	113'	86 10"	30'	1,408	17 000 lb. cargo capacity
	H.P.R 1	Marathon 1	Transport	2 18	4 DH Gipsy Queen 70	400	302	7,750	232	209	633	2 026	2 930	600	336	15,000	11 616	65	52'	14	488	3-engine climb is 246 fpm
Hawker Aircraft Ltd *Kingston-on-Thames*		Sea Fury F B 11	Fighter	1	1 Br Centaurus 18	2 478	2 500	6 000	460	310	4 300	1 410		930	240	12 330	8 796	38' 6"	34' 7"	14 8"	280	Service ceiling 37 000 ft.
		Sea Hawk	Fighter	1	1 R R Nene 4	5 000			590*									39'	40'	8' 2"	274	Height—wings folded 16 ft
	P 1067		Fighter	1	1 R R Avon	6 500+			550+												30	Gun—cannon
	P 1072		Fighter	1	1 R R Nene + rocket	5 000*			600*									28' 8"	37 2"	10 9"	280	Modified P 1040
Percival Aircraft Ltd *Luton Bedfordshire*	P 50	Prince 3	Transport	1 2 8-12	2 Al Leon 5m 502-4	550	430	7 600	208	195	1 110	2 280	1 950	894	303	11 000	7 611	50	42' 10"	16 1"	303	400 lb. cargo capacity
	P.56	Provost T.1	Trainer	2	1 Al Leonides 250	580	500	7 600	208	178	2 000	870		660	79	4,250	2 655	36 2"	29'	12'	214	Service ceiling 28,000 ft.
A. V. Roe & Co. Ltd. *Greengate Middleton Manchester*	698	Shackleton G R.1	Patrol	16	4 R-R Griffon 67	2,450			300*									120	77 6"	17' 6"	1,421	DH 6-blade contra props.
	709	Ashton	Research	4	4 R R Nene 5 6	5 000									3,720	52 000		120	89' 6"	30' 6"	1,421	High-altitude jet research.
	707A		Research	1	1 R R Derwent													34 2"	42 6"	11' 6"		Delta-wing research
	707B		Research	1	1 R-R Derwent													33	41	11' 6"		Delta wing research
Saunders-Roe Ltd. *Osborne E Cowes Isle of Wight*	SR/A/1		Fighter	1	2 M-V Beryl	6 350			600+						493	16 250		48'	50'	17'	415	Flying boat fighter
	SR/45	Princess	Transport	15 105	10 Br Proteus	6 500				380				5 500	17 600	115 000		219' 8"	148'	55' 6"	5 500	Three in order
		Duchess	Transport	6 92	8 DH Ghost	5 000*			550	500				2 000		120 000		135' 6"	124 6"		2 360	R-R Avons alternate engines.

(Footnotes on page 156.)

Foreign Military and Civil Aircraft

Manufacturer and Address	Designation		Category	Seats: No. of crew	Seats: passengers	Powerplant: Number, make and model of engines	Powerplant: Take-off power (SL) lb. thrust, or shp.	Powerplant: Normal rated power lb. thrust, or shp.	Powerplant: At altitude (ft.)	Performance: Top speed (mph.)	Performance: Cruising speed (mph.)	Performance: Initial rate of climb (fpm.)	Performance: No wind, SL takeoff over 50 ft. obstacle (ft.)	Performance: No wind, SL landing over 50 ft. obstacle (ft.)	Performance: Normal range (mi.)	Fuel: Normal fuel capacity (gal.)	Weights: Gross weight (lb.)	Weights: Empty weight (lb.)	Dimensions: Span	Dimensions: Length	Dimensions: Height	Dimensions: Wing area including ailerons (sq. ft.)	Remarks
Scottish Aviation Ltd *Prestwick Airport Ayrshire*		Pioneer 2	Personal	6		1 Al Leonides 501-4	930	440	S 750	190	134	740	780	900	480	79	5,866	4 030	49' 0"	34' 3"	10'	330	850 lb. cargo capacity
Short Bros. & Harland Ltd. *Queens Island Belfast*	S.A.3	Sturgeon T.T.2	Target Tow	6		2 R-R Merlin 140	2 480	1,850	18,300	315	155	3,090	1,700	2 800	1,160	510	22 350	18,000	55 11"	48' 6"	15'	668.5	45 ordered by Royal Navy.
	S.A 4		Bomber	6		4 R-R Avon	6 600+/-			600*									108'	102	23' 6"	1,400 ?	Diverted to equipment research.
	S.A.6	Seaford	Transport	1.5-2		3 DH Gipsy Queen 70-3	340	260	8,000	150	140	760	3 000	2 450	660	138	8 100	7 066	91' 6"	42' 3"	14	363 ft	1,500 lb. cargo capacity
Vickers-Armstrongs Ltd. *Aircraft Division Weybridge, Surrey*	498	Viking 1B	Transport	3-27		2 Br Hercules 634	1 690	1 440	16,000	263	210	1 275	2 550	2 550	1 705	900	34 000	28 250	89 3"	65' 3"	19' 7"	882	271.6 cu. ft. cargo capacity
	651	Valetta 1	Transport	4-34		2 Br Hercules 230	1 975	1 400	10 000	304	285	1,300	3 785	4 375		409	33 500	25 545	89' 3"	68' 3"	19' 8"	882	1,563 cu. ft. cargo capacity
	660	Valiant	Bomber			4 R-R Avon	8 500+			600*													Engines buried in swept wings
	668	Varsity	Trainer	11		2 Br Hercules 264	1,980	1 670	10 000	296	248	1 400	3 420	3 380	1 800	900	37 500	32 300	95 10"	67' 7"	23 11"	974	Service ceiling 27,500 ft.
	700	Viscount	Transport	2-3,46-48		4 R-R Dart RDa 3	1 450			370	340	1 525	4 850	2 530		2 064	52 500	35 330	94	81' 2"	26' 11"	963	417 cu. ft. cargo capacity
(Supermarine Works) *Hursley Park, Hants.*	508	Attacker	Fighter	1		1 R-R Nene 3	6 000			585	540	6 250	2 340	2 750	900	332	11 750	7 796	36' 11"	37' 1"	8' 7"	227	Service ceiling 49,500 ft. Butterfly tail
	508		Fighter	1		2 R-N Avon	6 000+/-			600+									31' 6"	42' 11"	12' 6"	295	Nene has afterburner
	535		Fighter	1		1 R R Nene 3	6-000+/-			600+													538 development.
	541	Swift	Fighter	1		1 R-R Avon	6 000+/-			600+													
Westland Aircraft Ltd. *Yeovil, Somerset*		Wyvern T.F.4	Fighter	1		1 AS Python	3 470			360*									40'	42'	15' 9"	335	Carrier-based
FRANCE																							
Arsenal de L Aeronautique *Chatillon-sa-Bagneux (Seine)*	VG-90		Fighter	1		1 Hisso Nene	5 068			562	375	4,530					17 000	11,220	40 11"	42	9' 1"	330	Carrier-based
Constructions Aeronautique du Bearn *Bassus Pyrenees*		Minimb	Personal	3		1 Con A65	95			143	112	900	494	1 010	437	13	1 088	594	27	18'	8' 6"	107	All-wood construction
Societe Boisavia *Ivry*		Mercury	Personal	4		1 Ren Fe	140			143	115	787	440	107	869		2 645	1 443	32' 11"	23'	9 10"	134	Absolute ceiling 18,044 ft.
S. A. des Ateliers d'Aviation Louis Breguet *Paris*	70	Deux Ponts	Transport	3 10		4 P&W R-2800-CA18	2 400	2 135		250	234	740			3 437	3 388	105 727	55 903	140' 10"	94 11"	31' 4"	1 965	5 897 cu. ft. cargo capacity.
	89-1R	Mara	Transport	4-20*		2 G.R 14 R200	1,600			227	180		2,541	2 892	700	1 220	37 070	25 300	100 3"	70' 10"	23' 7"	1 090	89-OH is pivil cargo versnn.
	960	Vultur	Attack	2		1 AS Mamba + 1 Hisso Nene				280	240				932		22 204	15 423	54' 3"	43 4"	10' 8"		Carrier-based 921 o angle seat.
Societe Avions Marcel Dassault *Paris*	MD-315	Flamant	Transport	2 10		2 Rm 12-5		390		236	186	984	1 509		795		12 566	9 880	59'	42'	15'	485	Other versions as trainers.
	MD-450*	Ouragon	Fighter	1		1 Hisso Nene	6 556			615	540	7 400	2 562	2 985	450	250	11 684	7 240	38' 7"	34' 6"	13'	269	MD-421 is photo version.
	MD-452*	Mystere	Fighter	1		1 Nene Nran	6 960			687													Swept-wing versnn of MD-450.
Avions Hurel-Dubois *Paris*	HD-10		Research	1		1 Praga D	76			101							1 144	726	39' 4"			46 08	Aspect ratio 32.5.
	HD-31		Transport	2-36		2 Wr C7BA	900			174	143	787	1 804	2 723	980		33 833	18 884	147' 7"	72 3"	21' 10"	1 077	Aspect ratio 20.2.

Manufacturer and Address	Designation		Category	Seats: No. of crew	Seats: passengers	Powerplant: Number, make and model of engines	Powerplant: Take-off power (SL) lb. thrust, or shp.	Powerplant: Normal rated power lb. thrust, or shp.	Powerplant: At altitude (ft.)	Performance: Top speed (mph.)	Performance: Cruising speed (mph.)	Performance: Initial rate of climb (fpm.)	Performance: No wind, SL takeoff over 50 ft. obstacle (ft.)	Performance: No wind, SL landing over 50 ft. obstacle (ft.)	Performance: Normal range (mi.)	Fuel: Normal fuel capacity (gal.)	Weights: Gross weight (lb.)	Weights: Empty weight (lb.)	Dimensions: Span	Dimensions: Length	Dimensions: Height	Dimensions: Wing area including ailerons (sq. ft.)	Remarks
Ets Fouga & Cie *Sterrers (Herault)*	CM8R-R-8	Cyclope 2	Personal	1		1 Turbomeca Palas	250			205		1 575	900*		186		1 254	902	28' 8"	21' 10"	5' 10"	106	Service ceiling 31 160 ft.
	CM8R-10	Splgbt	Personal	1		1 Turbomeca Palouo	242			186		787	1 400*		200	28	1 800	847	43	21' 10"		140	Service ceiling 27,225 ft.
	CM88	Gemeaux 1	Personal	2		2 Turbomeca Pinsun	242			205		1 135	2 000*		186		2 376	1,593	36' 4"	21' 10"		180	Two Cyclopes mound at mid wings.
	CM101R		Transport	2 14		2 Ren 123-9*	740			174	162	770	2 400				18 206	13 641	50 8"	58' 2"		774	Powered glider development
Societe Mus Holste *Paris*	MH 152		Personal	1 4		1 *Salmson 8AB	240			143	119	660					3 305	2 158	44	33'	9	264	2 prototypes built.
Nuss Leduc Fils *Argenteuil (Seine)*	010		Research	3		1 Leduc ramjet	3 500*			500?						400	8 160		34 9"	30' 7"	—	172	Air launched.
Societe Morane-Saulnier *Puteaux (Seine)*	MS-703		Personal	6		2 Salmson A9R.	240			186	161	1 102	1 475	1 030	740		5 951	4,188	40 1"	33' 4"	13'	270	MS-700 carries four
	MS-730		Trainer	3		1 Mathe 6C30	150			140	130	807			470		3 086	2,244	37 9"	30' 0"	11' 6"	300	Later models have more power
Societe des Avions Francois Ney *Boulogne (Seine)*	01		Research	2		2 Ren 6Q	300			300							6 600	5 510	43' 2"	30 2"	11 11"	207	7 Articulated wings.
Societe Francaise d'Aviation *Billancourt (Seine)*		Phrygaet	Personal	3		1 Salmson 5AQ	55			100	87				310		1 565	1 023	35 11"	23 2"	8' 6"	200	Service ceiling 13,120 ft
Societe Industrielle Pour l Aeronautique *Suresnes*	9111		Trainer	2		1 Ren 126-09	580	390	6 550	225	200	1 772			435	53	4 563	3 086	36' 1"	30' 7"	11' 0"	187	312 monlar
	S200		Personal	1		1 Turbomeca Palas	330				230				400		1 808	860	32' 8"	17'			Twin-boom layout.
	S901		Personal	2		1 Mio 4DC32	75			124	100	492			910		1 320	905	28' 8"	18' 10"	5' 9"	120	Later models more power
Societe Nationale de Constructions Aeronautiques du Nord *Paris*	NC853		Personal	2		1 Minn 4DC32	75			100	64				700		1 320	800	37	22	8' 8"		410 lb. cargo capacity
	N1203	Norecrin	Personal	4		1 SNECMA Regulor 4	147	110		174	137	824			960	28	2 343	1,353	34	24	9	140	000 lb. cargo capacity
	N1402		Patrol	5		2 Ar 12R	2 976			230	186			2 144	1 066	45 947	31 431	102' 8"	71 7"	24 8"	1 077	Amphibian
	N2000		Fighter	1		1 Hisso Nene	6 066			593		4 724	2 624		745	732	17 378	10 638	39'	44	15'	290	Carrier based.
	N2501		Transport	4-42		2 Br Hercules 758	2 940			324	304				932	840	44 000	28 460	106 1"	82' 8"	29' 6"	1 080	11,050 lb. cargo capacity
Societe Nationale de Constructions du Sud-Est *Paris*	SE161	Languedoc	Transport	5-33		4 P&W R-1830-92	1,200	1 050		273	233	591			1 075	1 885	45 364	27 890	80 5"	72 7"	18 10"	1 149	350 cu. ft. cargo capacity
	SE2010	Armagnac	Transport	7-11-20-107		4 P&W R-4360-B10	3 500			400	280	600	4 367	3 608	3 730	8 308	155 000	84,070	150' 1"	123' 0"	42' 7"	2 433	8 on order
	SE2410	Grognard	Attack	1		2 Nene Nnit	5 000			600							36 110		50' 7"	64 6"	13'	480	SE2415 seats 2.
	SE4020		Patrol			2 P&W R-985	450			262	146					157	9 140	7 015	69'	47	17	453	9 Or A5 Cheetah 410 h.p. ea.
		Mistral	Fighter	1		1 Hisso Nene	5 000			570		9 855			745		15 000		38' 8"	31			DH Vampire Mk. 53
Societe Nationale de Constructions du Sud-Ouest *Paris*	SO30P	Bretagne	Transport	4-30-42		2 P&W R 2800-B43	2 800			240		380	6 400			1 270	42 100	20 300	82' 2"	66' 3"	18 1"	927	3 570 lb. cargo capacity
	SO30P	Bretagne	Transport	4-30-42		2 P&W R-2800-TA18	2 400			247	231	310	5 400			1 270	44 500	20 900	82' 3"	62' 3"	18' 1"	927	3 3,580 lb. cargo capacity
	SO30 Nanet		Transport	4		2 Nene Nene	5 300	4 630		462	390	2 420	4 400		1 055	1 640	38 200		64' 7"	61		916	Jet transport research
	SO64	Corse 2	Transport	3-5		2 SNECMA 12	500	440		248	208	1,120	2,800	2 370	500	240	12 345	8,350	59'	40' 4"	14' 1"	464	2,500 lb. cargo capacity
	SO4000		Attack	2		2 Nene Nene	5 200			528						2 640	62 000	35 000	58' 7"	64 10"		780	SO4060 under development
	SO6021	Espadon	Fighter	1		1 Nene Nene	5 000			655		5 000				328	15 118	10 450	35'	49'	15'	291	SO6023 6026 are later models.

(Footnotes on page 156.)

Foreign Military and Civil Aircraft

Manufacturer and Address	Designation	Category	Seats: No. of crew / passengers	Powerplant: Number, make and model of engine(s)	Powerplant: Takeoff power (SL), hp. (lb. thrust, or shp.	Powerplant: Normal rated power, hp. (lb. thrust, or shp.	Powerplant: At altitude (ft.)	Performance: Top speed (mph.)	Performance: Cruising speed (mph.)	Performance: Initial rate of climb (fpm.)	Performance: No wind, SL takeoff over 50 Ft. obstacle (ft.)	Performance: No wind, SL landing over 50 Ft. obstacle (ft.)	Performance: Normal range (mi.)	Fuel: Normal fuel capacity (gal.)	Weights: Gross weight (lb.)	Weights: Empty weight (lb.)	Dimensions: Span	Dimensions: Length	Dimensions: Height	Dimensions: Wing area, including slipstream (sq. ft.)	Remarks
HOLLAND																					
Royal Dutch Aircraft Factories (Fokker) Schiphol Amsterdam	S 11	Instructor	Trainer 2	1 Ly O-435-A	190	110		150	102			400	400	34	2,422	1,906	36' 1"	26' 9"	7' 2"	200	S 12 has tricycle gear
	S 13	Universal Trainer	Trainer 6	2 P&W R-1340	600	550		220	190		1,000	1,000	200	264	12,785	9,225	63	44	7' 10"	435	Service ceiling 21,300 ft.
	S 14		Trainer 2-3	1 R-R Derwent 8	3,600			440	400	3,500	3,000	5,000		370	11,280	7,920	39' 5"	48' 8"	15' 4"	342	Service ceiling 45,000 ft
ITALY																					
S. A. I. Ambrosini Rome	S.7		Personal 1-2	1 Alfa Romeo 115	350	220		173	160	1,000			850	40	2,976	2,365	28' 9"	23' 9"	9' 2"	157.8	Or DH Gipsy Queen engine
Fiat-Sezione Aeritalia Turin	G.212 CP	Maritime	Transport 4 16 20	3 P&W R-1830-S1C3-G	1,200			224	200	585			1,700	1,185	39,700	24,700	96' 3"	75' 7"	21' 4"	1,258	Also a crew trainer
	1.46-2B		Trainer 2	1 DH Gipsy Queen 30	245			204	171	1,060			700	42	3,150	2,451	34' 2"	27' 10"	7' 11"	172.2	Also single-seat version
	1.46-4B		Trainer 2	1 Vlo Renco 115	232			194	154	1,085			560	42	3,145	2,425	34' 2"	27' 10"	7' 11"	172.2	Also single-seat version
	G.46-1		Trainer 1	1 Al Leon ides 502/4	550+			233	177	1,200			980	115	5,500	4,300	42' 9"	31' 5"	9' 1"	262.4	Service ceiling 28,500 ft.
	G.48-2		Trainer 2	1 P&W H-1340-S3H1	950			260	158	1,725			745	115	8,700	4,300	42' 8"	31' 2"	8' 8"	282.4	Service ceiling 25,500 ft.
	G.58-4A		Trainer 1	1 R-R Merlin 35-2	1,400			380	303	3,500			620	127	7,630	5,180	38' 11"	31' 1"	12' 1"	227	Service ceiling 30,700 ft.
	G.59-4B		Trainer 2	2 R-R Merlin 24-2	1,980			380	303	3,500			950	100	7,400	5,485	38' 11"	31' 1"	12' 1"	237	Service ceiling 30,700 ft.
	G.80-4B		Trainer 2	1 DH Goblin 35	3,750			550	435	4,000			875	350	11,900	8,000	38' 1"	40' 8"	13' 3"	270.6	Service ceiling 44,300 ft.
	G.80-2B		Trainer 2	1 R-R Nyas RN2-21	5,000			570	520	7,400			560	336	11,950	8,590	38' 1"	40' 8"	13' 3"	273.6	Service ceiling 48,000 ft.
Aeronautica Macchi Varese	MB-308		Personal 2	1 Lon C-85	85	65	SL	118	98	402			435	22	1,455	915	32' 10"	21' 4"	7' 1"	147.8	375 lb. cargo capacity
	MB-330		Personal 1-5	2 Con E-185	280	185	SL	200	174	1,122	1,312	1,181	930	98	4,956	3,284	42' 7"	28' 6"	10' 5"	227.8	1,100 lb. cargo capacity
SIAI-Marchetti Lurate	SM 95		Transport 5-20	4 P&W R-1830	1,200	1,050	7,500	242	215	984	1,080	1,180	1,245	2,132	52,870	31,980	112' 4"	81' 2"	17' 4"	1,381	4,200 lb. cargo capacity
	SM 102		Transport 5-10	2 P&W R-988	450	450	2,300	215	190	980	885	930	694	108	17,125	7,950	59'	45'	10' 5"	437	4410 lb. cargo capacity
Piaggio & Co. S.p.A. Genoa	P.136M		Personal 1-3	2 Ly GO-435-C2	240	240	SL	175	157	1,080	1,300	1,800	650	132	5,400	3,900	44' 3"	36' 5"	11' 5"	289	Amphibian. Also military models
	P-148		Personal 2-3	1 Ly O-435-A	190	190	SL	145	126	510	768	700	672	45	2,645	1,991	38' 5"	27' 8"	7' 11"	209.5	Also military primary trainer
SWEDEN																					
Svenska Aeroplan A.B. Linkoping	Saab-29	J 29	Fighter 1	1 DH Ghost	5,000			650									34' 1"	33' 1"	13' 4"	258	Variable incidence tail
	Saab-91A	Safir	Personal 3	1 DH Gipsy Major 10	145			164	146	945	1,115	556	556	28.5	2,100	1,278	34' 5"	25' 7"	7' 3"	146.3	Fixed tricycle gear
	Saab-91B	Sk-50	Trainer 3	1 Ly O-435-A	190	190		171	156	1,140	1,150	1,050	650	48	3,240	1,580	34' 5"	25' 7"	7' 3"	146.3	Swedish Air Force trainer

* — Approximate.
Al — Alvis.
Ar — Arsenal
AS — Armstrong Siddeley
ASW — Anti submarine warfare.
AvC — A. V. Roe-Canada.
AW Fighter — All-weather fighter
Bl — Blackburn & General Aircraft.
Br — Bristol.
Con — Continental.
DH — de Havilland.
G-R — Gnome-Rhône.
Hisso — Hispano-Suiza.
Ly — Lycoming.
M V — Metropolitan-Vickers.
P&W — Pratt & Whitney
Rgn — Renault
R-R — Rolls-Royce.
SL — Sea level
SNECMA — Societe Nationale d Etudes et de Constructions de Moteurs d'Aviation.
Wr — Wright.

Maximum range.
[1] DH 110 is 2-place all-weather sweptwing 650-mph.-plus fighter powered by two R-R Avons.
[2] AS Snarler 2,000 lb. sea level thrust rocket motor in tail for jests.
[3] MD-450 Harmaten is 2-seat all-weather fighter version.
[4] SNECMA Atar 101 turbojet of 6,160 lb. thrust installed Dec. 1951.
[5] One Turbomeca Pimore turbojet of 242 lb. thrust is installed in rear of each engine nacelle to provide extra takeoff power.
[6] Speed given is at half-power at 36,000 ft.
[7] Data obtained in tests will be used in design of upcoming SO 9.90 Champagne four-jet civil transport.
[8] Saab is flight testing a single-turbojet powered delta-wing (type 210) as part of upcoming delta-wing fighter project.

Leading Foreign Jet Engines

Manufacturer and Address	Designation	Type	Stages: Compressor	Stages: Turbine	Performance—Turbojets: Static thrust @ SL (lb.)	Performance—Turbojets: At rpm.	Performance—Turbojets: Rated thrust (lb.)	Performance—Turbojets: At rpm.	Performance—Turboprops: Shaft horsepower	Performance—Turboprops: At rpm.	Performance—Turboprops: Equivalent hp. @ SL	Performance—Turboprops: Max. cont. cruising hp.	Performance—Turboprops: At rpm.	Performance—Turboprops: At altitude (ft.), & mph	Performance—Turboprops: Max. residual thrust @	Performance—Turboprops: Propeller reduction gear ratio	General: Fuel flow (gph.)	General: Specific fuel consumption (lb. hr. lb. thrust or lb. hp. hr.)	General: Compressor air mass flow @ max. rpm. (lb. per sec.)	General: Compressor pressure ratio	Temperatures: Turbine inlet deg. (°)	Temperatures: Maximum airplane (deg. C)	Dimensions: Length (in.)	Dimensions: Maximum diameter (in.)	Weights: Dry weight (lb.)	Weights: Total weight (lb.)	Equipment: Make starter supplied with engine	Equipment: Type starter supplied with engine	Equipment: Engine's status
AUSTRALIA																													
Commonwealth Aircraft Corp., Pty Ltd. *Lasrner St. Port Melbourne*	Nene	CFAF	1	1	5 000	12 300	6 000	12 300	NA	NA	NA	NA	NA	NA	NA	NA	670	1	91	4 1									LP
CANADA																													
A. V. Roe Canada Ltd. *Malton, Ont.*	Orenda	AFJ	10	1	6 000+				NA		NA	NA		NA	NA		1 *											Elec	LP
ENGLAND																													
Armstrong Siddeley Motors Ltd. *Parkside, Coventry*	Adder 1 Sapphire ASSG3 Double Mamba ASMD1 Python Mk. 3 Sapphire ASSG3	ABJ AFP AFP AFP AFJ	10 10 10 14 22	1 2 2 2 2	6 000 NA NA NA 7 220	15 000 NA NA NA	NA NA NA NA	NA NA NA NA	NA NA NA NA	NA NA NA NA	NA NA NA NA	NA NA NA NA	NA NA NA NA	NA NA NA NA	405 810 810 1 180	1 471 2 940 2 351 4 123 5 300	14 500 14 500 14 500 13 525 14 500	31, 300 31, 300 31, 300 30, 300 31, 300	140 270 270 415	135 270 225 0 0	0 73 729 0 01	17 0 15 17 0 7 1 *	0 1 5 1 5 1 7 1 *	877 877 877 877	500 865 850 599	73 3/8 87 7/8 71 5/8 68 3/4 121	29 29 28 8" 28 5/4 35 0	3 450 335 3 450	890 Rotax 740 Rotax† 705 Rotax† BTH BTH	Elec Elec Turbo Elec Elec	LP LP LP LP LP
Bristol Aeroplane Co., Ltd. *Filton, Bristol*	Proteus 2 Proteus 3	AXPF AXPF	12 12	3 3	NA NA	NA NA	NA NA	NA NA	6 000 6 500	10 000 10 000	7 200 7 800	6 400 6 400	10 000 10 000	33, 000 33, 000	700 700	6541 6541	1544 1544	00 00	45 45	Abt 710 Abt 710	110 110	90 90	1 614 1 614	387 9 387 9	7 000† 7 000†	BTH BTH	Elec Elec	LP LP
de Havilland Engine Co., Ltd. *Stonegrove, Edgeware, Middlesex*	Ghost 48 Gnome 2	CFJ CFJ	1 1	1 1	3 000 6 000	10 750 10 250	2 350 4 300	10 000 9 750	NA NA	NA NA	NA NA	NA NA	NA NA	NA NA	NA NA	NA NA	5 50* 7 00*	1 14 1 09*	98* 90*	4 1 4 1			1 619 2 174	2 164 2 164	Rotax Rotax	Elec Elec	XMO
D. Napier & Son Ltd *London W. 3*	Nomad?	ACFP*			NA	NA	NA	5 000							390			36			227	58 9	4 000					
Rolls-Royce Ltd. *Derby*	Dart 505 Nene 4 Dart 505 Avon R.A. 8 Mk. 1	CFJ CFJ CFP AFJ	1 1 2‡ 8	1 1 2‡	5 400 5 000 NA 9 500	14 700 12 500 NA 7 400	11 000 11 500 NA NA	14 100 11 500 NA NA	NA NA 1 400 NA	NA NA 14 400 NA	NA NA NA NA	NA NA NA NA	NA NA NA NA	NA NA 30 000 NA	NA NA NA NA	NA NA NA NA	492 975 135 770	1 05 1 04 0 91 98	65 90 5 78 80	4 6 1 4 1 5 0 1	810 950 800		83 97 93 110	43 44 5 35 5 41 0	1 250 1 600 925 9 240	Rotax Rotax Rotax Rotax	Elec Elec Elec Elec	LP LP LP LP
FRANCE																													
Société d'Exploitation des Matériels Hispano-Suiza *Colombes (Seine)*	Nuni Tiny	CFJ CFJ	1 1	1 1	5 046 6 260	12 300 12 300			NA NA	NA NA	NA NA	NA NA	NA NA	NA NA	NA NA	NA NA		1 05 1 05	68				93 94	49 49	1 406 1 371				LP LP
Société Potain *La Courneuve (Seine)*	SNA 101	AFJ	10	2	7 275‡	9 000	6 070	9 000	NA	NA	NA	NA	NA	NA	NA	NA	6 8 1		86	117			121	43		2 200	Rotax	Elec	XMO
Société Nationale d'Etude et de Construction du Moteur d'Aviation *Paris 8*	ATAR 101C TR1000	AFJ AFP	7 9	1 2	6 160‡ NA	8 000 NA	NA	NA	NA	NA	NA	NA 1 000	NA 14 000	NA 12, 100	NA	NA 1091		4 6					112 106	34 9 32 6	1 300 950	1 455	ATAR		XMO XMO
Société Turbomeca *Bordes*	Artouste Aspin 1 Marboré Palor Planore	CFP CFJ CFJ CFJ CFJ	1 1 1 1 1	1 2 1 1 1	NA 440 660 352 242	NA 33, 000	NA	NA	550 NA NA NA NA	36, 000 NA NA NA NA	NA NA NA NA NA	NA NA NA NA NA	NA NA NA NA NA	NA NA NA NA NA	NA NA NA NA NA	NA NA NA NA NA		85 63 1 22 1 65			3 61			31 47 54 41 41	9 4 9 0 9 0 9 0 9 0	195 279 264 132 114	Art Art	Elec Elec	XMO XMO LP LP

* — Approximate.
ACFP — Axial and centrifugal-flow turboprop.
AFJ — Axial-flow turbojet.
AFP — Axial-flow turboprop
Aq — Air Equipment.
BTH — British Thomson-Houston.
CFJ — Centrifugal flow turbojet.
CFP — Centrifugal flow turboprop.
Elec — Electric.
Hyd — Hydraulic.
NA — Not available.
SL — Sea level
XMO — Experimental models only

† Other standard gear reduction gear ratios are 13 and 20:1.
‡ Or Armstrong Siddeley Motors' air starter
§ Per equivalent shp.
¶ Maximum width.
¶ Or Armstrong Siddeley, British Thomson-Houston starters.

‡ Or 127 l.
§ Two-engined Gnome 13-cyl. horizontally opposed engine compounded with an axial-flow and centrifugal-flow compressor in series. Two auxiliary combustion chambers provide extra takeoff power—using auxiliary turbine.
¶ Or Pinney turbo.

‡ Or Rolls-Royce turbo.
§ Or Bristol Siddeley Motors' starter injection.
¶ 9,700 lb. thrust using afterburner.
† Plus one Centrifugal stage.
‡ Including Starter

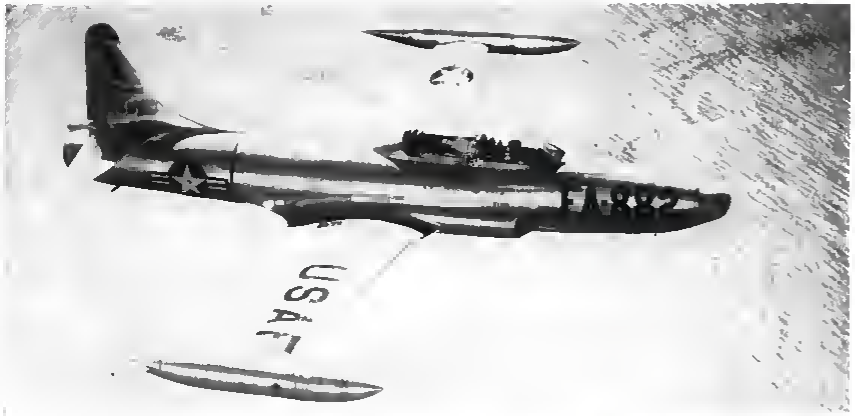
North American XA2J-1 Savage

U.S.A.'s Leading Military Aircraft

(Pages 161–166)

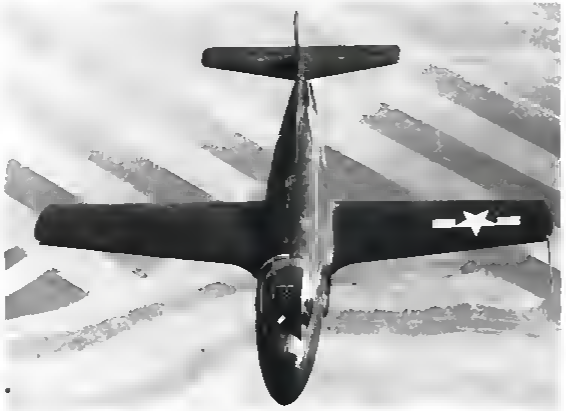
Consolidated Vultee XP5Y-1

Douglas XA2D-1 Skyshark

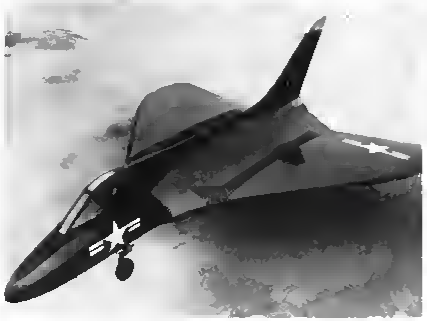


Lockheed F 94B

U.S.A.'s Leading Military Aircraft



Douglas F3D-1 Skyknight

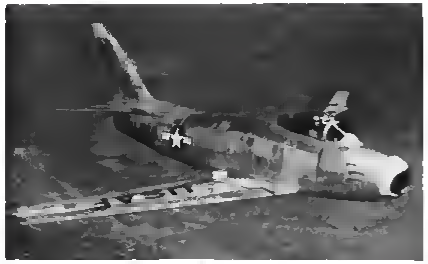


Douglas XF4D 1 Skyray

Consolidated Vultee XF 92A

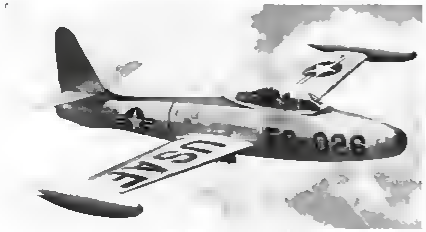
Leading Military Aircraft of the U.S. Armed Forces . . .

Republic XF-91



North American F-86E Sabre

Lockheed P2V-5 Neptune



Republic F-84E Thunderjet

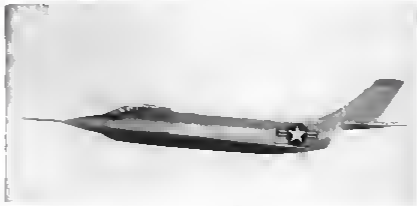
Lockheed F-80C Shooting Star

Northrop F-89D Scorpion

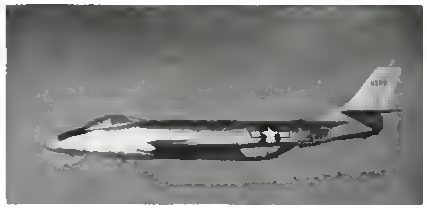
Grumman F9F-5 Panther

Martin B-61 Matador

Martin XB-51



McDonnell XF-3H-1 Demon



McDonnell XF-88A Voodoo

Vought F7U-1 Cutlass

Martin P5M-1 Marlin

Lockheed T-33A

North American AJ-1 Savage

Douglas AD-5 Skyraider

Leading Military Aircraft of the U.S. Armed Forces . . .

Republic F-84F Thunderjet

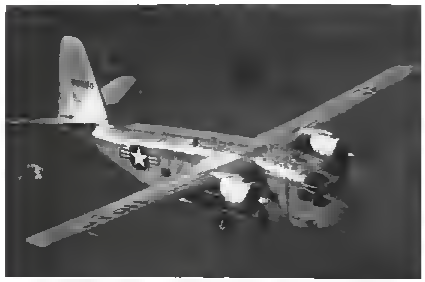
Boeing B-50D Superfortress

McDonnell F2H-2P Banshee

U.S. Military and Civil Transport Planes . . .

Chase XC-123A

Boeing KC-97A



Chase C-122

Boeing Stratocruiser

Douglas DC-6B

Douglas Super DC-3 (Navy R4D-8)

Douglas C-124A

Lockheed 1049 Super Constellation

Chase C-123 Avitruc

Douglas R6D-1 Liftmaster

Consolidated Vultee 340 Convair Liner

Douglas DC-7

Martin 4-0-4

Boeing C-97C Stratofreighter

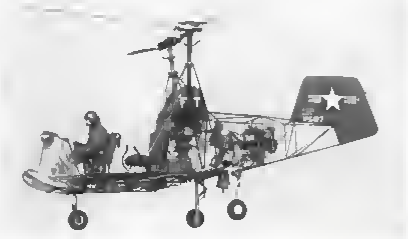
Beech 50 Twin Bonanza

Beech D18S

Leading U.S. Civil and Military Helicopters . . .

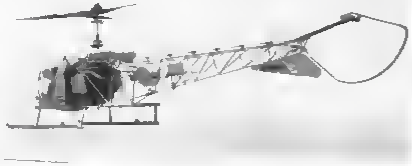
Piasecki HUP 2

Hiller H1E 2



Kaman K 225

Hiller HJ-2 Hornet



Bell H 13D

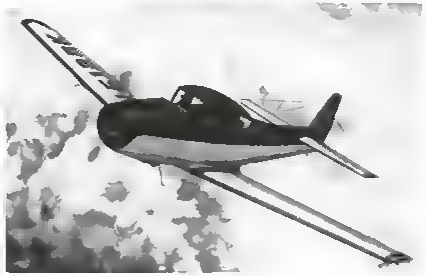
Piasecki H 21

Sikorsky H 19

Doman LZ 5

Some Popular U.S. Personal and Executive Aircraft . . .

Beech C 35 Bonanza



Ryan Navion Super 260

Aeronca Sedan

Piper PA 18 Super Cub

Mooney M 18LA

Cessna 170

Taylorcraft Sportsman

Piper PA 20 Pacer

Vickers Armstrongs 660 Valiant (Great Britain)

Hawker P. 1067 (Great Britain)

Leading Foreign Aircraft

Armstrong Whitworth Meteor N.F. 11 (Great Britain)

Three Interesting Foreign Planes

Vickers Armstrongs 700 Viscount (Great Britain)

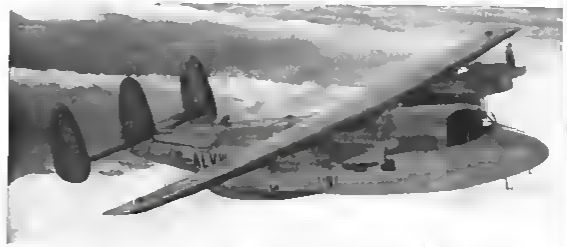
Gloster G A 5 (Great Britain)

Supermarine 508 (Great Britain)

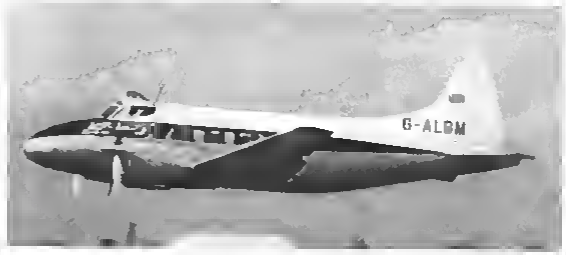
Some Leading British Transports

De Havilland 106 Comet Series 1 (Great Britain)

Airspeed AS-57 Ambassador (Great Britain)



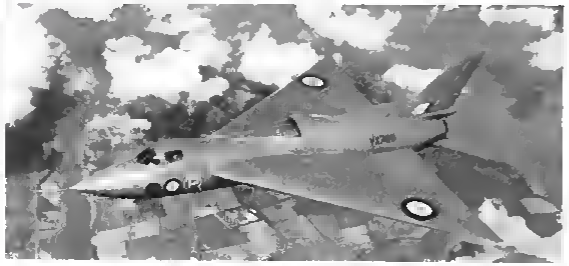
Handley Page HPR1 Marathon 1 (Great Britain)



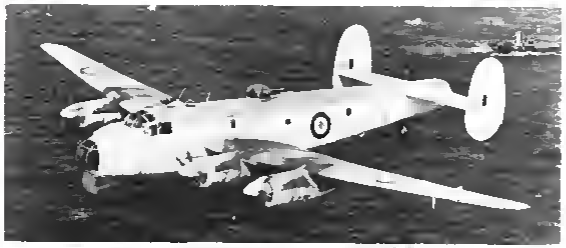
De Havilland 104 Dove (Great Britain)

Some Interesting Foreign Planes

Leduc 010 Ramjet Research (France)



Avro 707B (Great Britain)

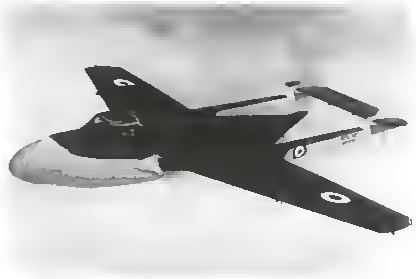


Avro 696 Shackleton G R 1 (Great Britain)

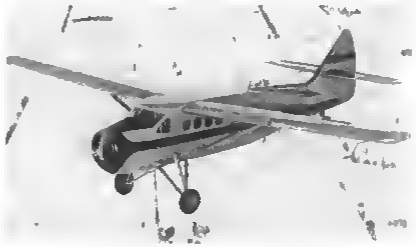
Breguet 76 Deux Ponts (France)

Some Interesting British and Canadian Planes

De Havilland D.H. 110 (Great Britain)



De Havilland Sea Venom (Great Britain)



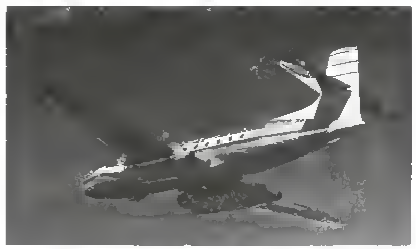
De Havilland Otter (Canada)

De Havilland Beaver (Canada)

Canadair Four (Canada)

Canadair Five (Canada)

Avro CF 100 (Canada)



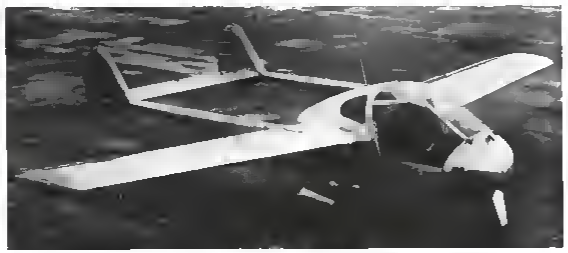
Avro Jetliner (Canada)

Interesting Foreign Planes

Marcel Dassault MD-450 Ouragon (France)

SF 2010 Armagnac (France)

Marcel Dassault MD-452 Mystere (France)



SIPA 200 (France)

Some Interesting Foreign Planes

SO 6026 Espadon (France)

Breguet 89 Mercure (France)

Breguet 892 Mercure (France)

SF 2410 Grognard (France)

Nord NC 853 (France)

United Kingdom Civil Aviation Budget

Category	1946–38	1946–47	1947–48	1948–49	1949–50	1950–51	1951–52
Salaries	£540 000	£1 350 000	£2 002 550	£3 757 553	£3 508 084	£3 436 000	£3 833 000
Traveling and incidental expenses	33 000	80 000	100 000	200 000	200 000	230 000	230 000
Air Transport Advisory Council		3 000	2 800	10 000	3 000	4 000	3 500
Non-technical supplies and transportation	70 000	270 000	348 000	522 000	356 000	377 000	473 000
Equipment, stores and ancillary services	340 000	1 285 000	1 953 000	2 289 000	1 613 500	1 332 000	1 481 500
Civil aircraft and associated equipment	5 095 000	10 000 010	7 000 000	10 314 000	4 638 000	2 400 000	200 000
Works, buildings and lands	305 000	6 330 000	6 000 000	4 852 000	6 465 010	6 641 010	6 879 000
Ground services for Commonwealth and other routes	160 000	700 000	1 335 000	2 700 000	1 645 000	1 226 700	1 050 000
Meteorological services	20 500	6 800	237 500	418 389	164 000	197 500	193 000
Grants to BOAC	10	4 810 000	12 100 000	5 250 000	6 557 000	6 070 000	5 000 000
Grants to BEA		870 000	4 400 000	2 000 000	1 700 000	1 000 000	700 000
Grants to BSAA		50 000	100	400 000			
Grants to associates of the Airways corps		10 000	10 000	50 000	100 000	80 000	25 000
Various aviation services: other grants and expenses	47 000	288 500	167 400[3]	295 400	160 000	141 150	100 500
Catering service			11 000	73 000	61 000	10 000	13 400
Contributions to ICAO					111 000	20 000	72 000
Overseas telephone and telegraph services					65 000	66 000	65 000
Grants to flying and gliding clubs						12 000	10 500
Miscellaneous expenses	46 000	70 000	100 000	207 000	65 100	148 000	74 500
Totals	£7 000 010	£31 000 010	£38 868 350	£38 278 889	£26 718, 099	£23 927 220	£20 000 000

NOTE: British pound quoted at $2.80
SOURCE: Civil Estimate

UK Air Power Caught in Budget Squeeze

- Nation on brink of bankruptcy must think of dollars as well as of its defenses.
- So Britain must translate its research into production models fast enough to sell to allies.

By Nat McKitterick
(*McGraw-Hill World News*)

London—The facts of life in Britain are such that rearmament has not—can not have—top priority in this grim year of 1952. National solvency comes first, and that means production for export. A country on the brink of bankruptcy could hardly make another decision.

This overriding consideration is having profound effects on the British aircraft industry. Not only is it bound to limit Britain's short-term contribution to Western air power (AVIATION WEEK Dec. 31, p. 12), it is a long-term consideration that is threatening fundamental changes inside the industry. No longer can the industry justify itself by only providing the RAF with world-beating fighters and bombers. Aircraft manufacturers, hardly less than Scotch whiskey distillers, must at the same time increase their earning power abroad.

The price of failure in its breadwinning roll may condemn large sections of the industry to extinction on the grounds that they are too expensive for the lean British pocketbook.

▶ **The Challenge**—The industry is facing this challenge with typical British resolution. Last fall Vice Chief of Air Staff Sir Ralph Cochrane spoke for all when he said, "Air power, if it is to be permanent, must be broadbased on commerce. We built up our sea power on ships, built in the country for owners all over the world as well as for our own trade. This had great influence on our life as a seafaring nation. The air must do the same and I see no reason why it should not."

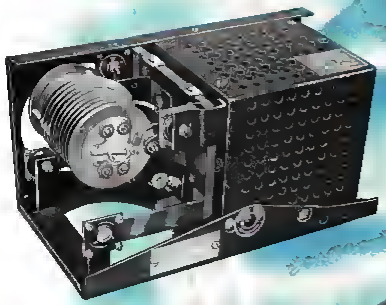
Industry men are rapidly adjusting their sights to this still distant target. Some industry men feel that the gigantic

United Kingdom Military Aviation Budget

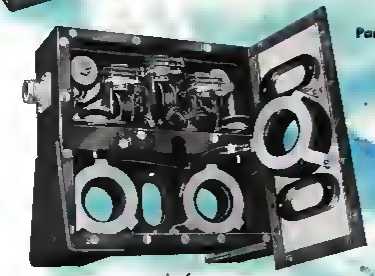
Year	Supplies	Aircraft & Stores	Works & Lands	Total
1946–47	£22 000 000	£39–998 000	£28 978 050	£270 026 800
1947–48	26 701–000	76 028 000	31–000 000	239–168–800
1948–49[2]	23 810–000	87 050 000	26–500 000	210 705–000
1949–50	29 381–000	82 500 000	28 700 000	238–881–000
1950–51[3]	34 403–000	97 500 000	28–500–000	267–452 100
1001–52[3]	44 150–000	130 750 000	44–220 000	276 999 100

NOTE: Budget is given in partial detail only. Figures given are "Gross estimates." Gross estimates represent the sum of "Appropriations in aid" (receipts at division or department from sales, loans, services, etc.) and "Net estimates," (new funds appropriated). Gross estimates are therefore total expenditures. Categories omitted from this table are: Air Force Pay; Reserve and Auxiliary Forces; Air Ministry Civilians and Outstations; Movements; Miscellaneous Effective Services; Non-Effective Services; Additional Married Quarters.
British pound quoted at $2.80.
[1] Estimates revised in include supplementary estimates.
[2] Provisional, no supplementary recorded.
SOURCE: Air Estimates.

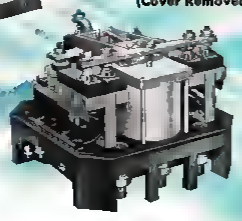
The A-C Control Panel includes an automatic voltage regulator, an exciter control relay, an exciter protection relay, and three differential current protection relays.



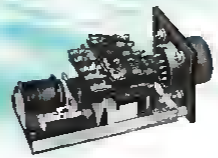
Aircraft alternator voltage regulator



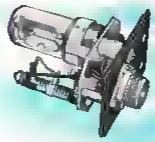
Partially disassembled differential relay protective assembly



Circuit breaker (Cover Removed)



Exciter control relay (Cover Removed)



Exciter protection relay (Cover Removed)

Current transformer

Millions of Air-Borne Kilowatthours Protected by Westinghouse A-C Control

Westinghouse offers actual service-tested components for complete control and protection of a-c power systems. Exciter field relays, circuit breakers, differential relays, exciter protection relays and voltage regulators have accumulated millions of successful operating hours under flight conditions.

As individual units, or built into compact control panels, their design reflects years of engineering and operating experience.

The practical a-c system for aircraft was pioneered and developed by Westinghouse. The results of this experience in products and services are available for your applications.

Our latest plug-in control panels, for example, offer space and weight savings, simplified airplane wiring and installation. They minimize ground time and reduce maintenance costs.

Go to the leader in aviation experience. For the best equipment and advice on a-c systems, call your nearest Westinghouse representative or write Westinghouse Electric Corporation, Aircraft Department, Lima, Ohio. J-03003

YOU CAN BE SURE... IF IT'S Westinghouse

production effort across the Atlantic may spell their doom if they don't. The day may come again when the U. S. has surplus fighters and bombers to give away or sell to its allies at a nominal price. If the planes are good enough, any British government will have to think twice before turning them down. From the point of view of keeping Britain a prospering country economically, nothing is more wasteful than spending money on expensive military airplanes. As one RAF official put it, "You might as well dump the money into the Channel."

▶ **The Search**—That's why in this year of 1952 you are bound to find British civil and military airmen thinking long and hard about how they can take the fullest advantage of their technical superiorities and other advantages such as their geographic position in the still sprawling British Empire and Commonwealth. Only as a worthy competitor of the U. S. can the British aircraft industry hope to survive.

First Job: Research

The RAF, always more ready to foster new developments than to spend money on quantity production, will continue to put top emphasis on research this year. The sort of thing that will get continued special attention is the development of the delta wing configuration for bombers, fighters, and future transports. It's an open secret that the Avro 707A and 707B are the heralds of an ultra-high altitude, sonic jet bomber, being built by A. V. Roe at Manchester. The Boulton Paul 111 and the Fairey F.D. 1 deltas point to supersonic interceptors. The Handley Page HP88 test craft with a crescent wing, which crashed last summer, was a testbed for Handley Page's high altitude bomber with compound leading edge taper wing.

▶ **Some Answers**—The delta-winged Gloster GA5 all weather fighter is the first end product of this research. This year may bring to light more—all of which the RAF hopes will make the USAF sit up and take notice.

It is generally agreed that it is probably too late now to sell to the U. S. earlier designs like the Vickers Valiant four-jet bomber or the Hawker P. 1067 fighter. Fighter and bomber programs are too far advanced in the U. S. now to justify a switch over except in a case of marked technical superiority. But the British hope they will be able to deliver that superiority again in the future as they did with the English Electric Canberra and a long line of jet engines in the recent past.

Research in the gas turbine line has similar possibilities. Industry expects later versions of axial flow jets now in operation to deliver 10,000-lb. thrust and over with specific fuel consumptions go

British Air Power

Royal Air Force

COMMAND OR FUNCTION	NOW IN SERVICE		DELIVERIES IN 1952	FUTURE
Fighter Command	Meteor VIII Vampire V Vampire N. F. 10 Meteor N. F. 11 Mosquito		Venom II Meteor VIII Meteor N. F. 11 Vampire V Vampire N. F. 10	Swift (541) P. 1067 GA5 DH 110
Bomber Command	Canberra Washington (U. S. B-29) Lincoln Meteor P. R. 10		Canberra Meteor P. R. 10	Valiant Avro? Handley Page?
Transport Command	Hastings Valetta Anson Prentice Devon		Hastings Valetta Anson Fairchild C-119?	OAL 60? Bristol 171? Comet type?
Coastal Command	Shackleton Neptune (U. S. P2V) Lancaster Sunderland Hastings Sycamore (helicopter)		Shackleton Neptune (U. S. P2V) Sycamore	
Flying Training Command	Oxford Anson Wellington Valetta Varsity Brigand Harvard (U. S.)	Mosquito Pembroke Meteor 7 Chipmunk Prentice Ballliol	Ballliol Prentice Meteor 7 Valetta Varsity Chipmunk	Auster 6, 7

Royal Navy

Fighter	Seafox Sea Fury Sea Vampire 20 Hornet Attacker Sea Hornet 21 (N. F.)	Sea Hawk Attacker Sea Fury Sea Venom Sea Vampire 20	Vickers 508 (revised) Swift (541)? DH 110 (N. F.)?
Strike and Torpedo	Mosquito TR 33 Firebrand TF 5A	Wyvern Mk 4 Firebrand TF 4	
Anti-Sub	Firefly Mk 7 Skyraider (U. S. AD-4 W)	Firefly Mk 7 Neptune (U. S. P2V-5)	Gannett (17)
Reconnaissance and Rescue	Firefly 4, 5 Sea Otter Anson S-51 Dragonfly (helicopter) Sycamore (helicopter)	Firefly 4, 5 S 51 Sycamore	S-55 (helicopter) (in 1953)
Transport	Prince Anson	Sea Prince Anson	
Trainer	Oxford Anson Harvard Firefly Sea Fury Meteor 7	Sea Balliol Sea Prince Sea Fury Meteor 7	

? Likely additions.

SOURCE. Compiled by McGraw-Hill World News.

ing down to .7/lb./hr./lb. thrust and below. Although the Avon and Sapphire jets are officially rated as 6,500 lb. and 7,200 lb. thrust respectively, use of improved metals, research on combustion chambers, and tests on compressor efficiency have raised these outputs to well over 8,000-lb. thrust for normal installations—that is, without afterburning or water injection.

▶ **Missiles Impressive**—In the guided missile line, U. S. engineers visiting Britain last year went away more than impressed. New methods of homing guided missiles and of controlling ultra-highspeed rockets have been brought almost to the production stage. Reports have constantly stressed the importance of expendable turbojets of late, and it's expected that the British will enter a competitor to the Matador this year.

Security prevents any real comparison of the guided missile program in the two countries, but it's safe to say that the British are devoting some of their best aviation brains to the field. Development of a new type air defense of the British Isles, less wasteful of materials and manpower, couldn't have a higher priority and it may be that such a development will come through guided missiles.

▶ **Air Bases**—The geographical position of the British Empire and Commonwealth is also getting a lot of attention from RAF officials as well as industry

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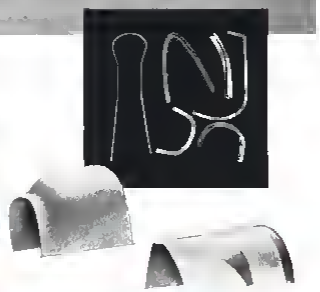

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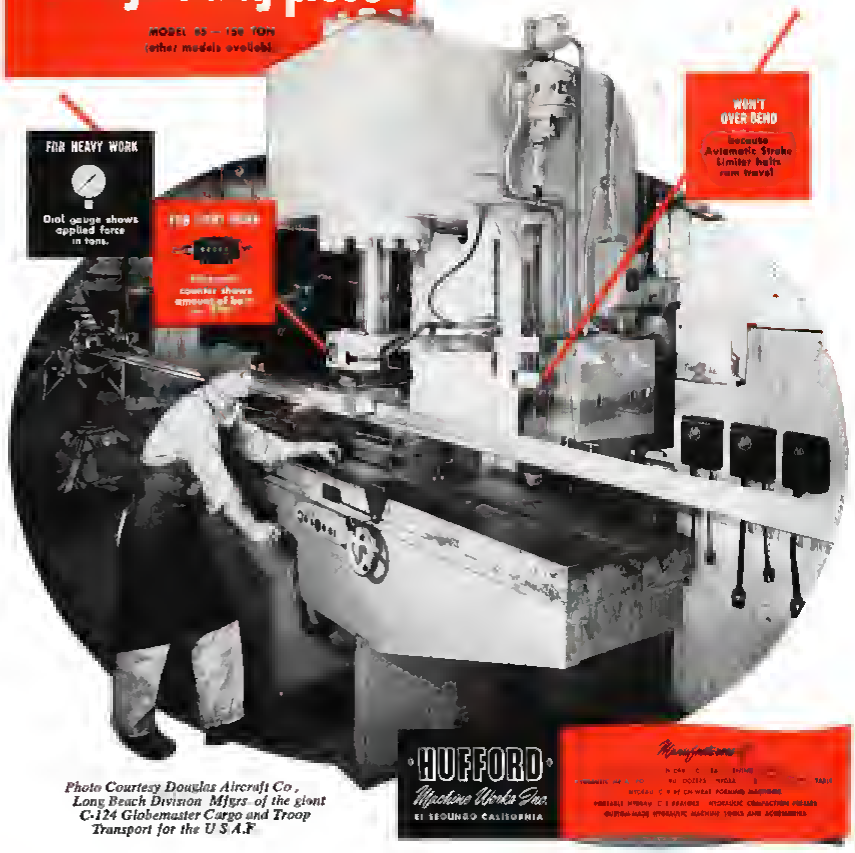

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men from the angle of providing something the U. S. wants from what Britain controls. Trouble in the Far East is giving this subject great topical importance right now. If you trace the course of U. S. airbases westward over the Aleutians, through Japan and Okinawa to the Philippines, then start from the east coast, through North Africa to Arabia, you will see that a gap equal to more than a third of the world's circumference exists between the two terminal points. More than any Western power, the British have important influence left in this part of the world.

Top secret negotiations between the U. S. and Britain are now going on over the question of bases in South and Southeast Asia. British bases in Malaya and North Borneo are the most important, for if we end up in an air war against China, these bases on China's southern flank may be of paramount importance.

In a more peaceful future, a system of commercial and military air bases in this part of the world could be of great strategic importance to the U. S. and Britain—as well as a good source of trade and revenue to both.

A Lead to Save

The big question for 1952 in the industry itself is likely to be "How can we keep our lead in jet transports?"

Rearmament troubles, of course, will dominate the day-to-day thinking of managers and technicians. But behind them all will be the challenge for the future. And the many happy coincidences of defense and commerce that underline Sir Ralph Cochrane's challenge indicate that the solution to today's rearmament worries may be the solution needed to strengthen the industry for the future.

Already the British government has assured the industry that production of the four existing turbine transports will get as high a priority as rearmament orders.

De Havilland now has about 50 orders for Series I and Series II Comets on its books now, about enough to break even on its original investment. Bristol Aeroplane, whose Britannia 175 transport will fly for the first time in June, is already talking of building the plane abroad—maybe in Canada.

But the key question still begs an answer. Most of the existing orders go to bolster BOAC and BEA (see p. 194), both badly in need of re-equipment. The Series I Comet will be in service this May on the London-Johannesburg run. The Vickers Viscount will be in service towards the end of the year on BEA's longer Continental runs. Both planes will then be fixing showrooms for British industry.

If they live up in service to their advance billing, de Havilland and Vickers will get a handsome lot of new interest. Then comes the test of whether the industry will be able to take advantage of the market.

▶ **Drive For Support**—There is little doubt that the industry will need a fair-sized new investment—more modern tools, more labor—if this opportunity is to be seized. While rearmament is in full swing, this is pretty much out of the question, as far as tools are concerned, anyway. But the industry realizes it's none too soon to start lobbying for a bigger share of Britain's limited investment capital.

The industry is plugging hard at the advantages of aircraft as exports. They point out that an airplane brings in about £10 sterling per lb. of weight as against about five shillings per lb. of weight for an automobile. Being less

United Kingdom Airline Operations

Year	Aircraft miles flown (000)	Passengers carried	Passenger miles flown (000)	Freight (tons)	Freight ton miles (000)	Mail (tons)	Mail ton miles (000)
1938	13 220	219 000	83 412	2 740	1 068	4 470	3,790
1940	5 953	67 000	42 347	655	1 090	1 550	2 910
1941	7,558	84 000	54 455	992	1 929	1 986	3,110
1942	10 880	109 000	103 110	2 556	3 000	1 830	2 950
1943	13 100	133 000	124 777	4 490	8 580	2 190	3,810
1944	19 480	169 000	170 208	7 330	15 510	3,340	4,480
1945	28 091	281 000	301 901	7 790	19 650	2 779	5,585
1946	36 917	426 000	392 841	4 490	8 945	2 950	7,790
1947	36 522	586 000	441 190	8 556	11 200	3 300	9 050
1948	44 206	712,000	556 536	8 950	17 100	4,660	10,930
1949	44 257	921 000	614 943	15,880	19 880	5 810	11,910
1950	49 152	1 194 000	792 300	21 292	34 130	7 140	13,394
1951*	58,637	1,426 000	1 022 100	37,960	31 073	8 179	15,717

[1] Estimates based on first eight months. [2] Converted to short tons.

SOURCES: *Annual Abstract of Statistics, No. 87 (1938-1949); Monthly Digest of Statistics.*

BOAC Operations

Year	Aircraft miles flown (000)	Passengers carried	Passenger miles (000)	Freight (tons)	Freight ton miles (000)	Mail (tons)	Mail ton miles (000)	Unduplicated route mileage
1947-48	29 846	101 001	297 955	2 309[1]	7 731[1]	1 303	7 890	58,818
1948-49	29 873	121 399	362 690	3 658[1]	12 387[1]	1 880	8 945	60,954
1949-50[2]	31 941	154 557	426 374	4 428[1]	17 077[1]	2 003	10 184	70,858
1950-51	30 824	200 714	559 449	8 593[1]	23 073[1]	2 372	13 042	73,677
1951 [3]	17,189	136 631	430 953	5 096	13 706	1 510	8,926	99,301

Note: Figures given as of Mar. 31.

[1] Includes excess baggage.

[2] British South American Airways Corp. merged with BOAC July 1949.

[3] Figures for first six months of fiscal year, April-September inclusive.

SOURCES: *BOAC annual reports, Ministry of Civil Aviation (1951).*

BEA Operations

Year	Aircraft miles flown (000)	Passengers carried	Passenger miles (000)	Freight (tons)	Freight ton miles (000)	Mail (tons)	Mail ton miles (000)	Unduplicated mileage
1947-48	13 095	911 822	122 479	2 300[1]	1 714[1]	1 530	630	13 044
1948-49	12 815	977 122	194 038	3 760[1]	2 949[1]	2 930	1 270	11 885
1949-50	17 321	781,813	213 980	7 710[1]	3 264[1]	4 005	1 890	13 190
1950-51	21 200	903 589	268 961	11 263[1]	4 401[1]	5 249	3 154	17,632
1941[2]	14 142	756 581	900 246	6 928	2 783	3 000	1 189	19 972

Note: Figures given as of Mar. 31.

[1] Includes excess baggage.

[2] Figures for first six months of fiscal year, April-September inclusive.

SOURCES: *BEA annual reports, Ministry of Civil Aviation (1951).*

Accidents on United Kingdom Airways

Scheduled Passenger-Carrying Airlines

Year	No. of fatal accidents	Passenger fatalities	Crew fatalities	Aircraft miles flown per fatal accident	Passenger miles flown per passenger fatality	Passenger fatalities per 100 million passenger miles
1936	3	11	16	N.A.	N.A.	N.A.
1937	5	8	10	N.A.	N.A.	N.A.
1938	4	12	8	2 201 000	3 813 000	10 8
1939	5	0	7	N.A.	N.A.	N.A.
1940	1	4	4	N.A.	N.A.	N.A.
1941	1	0	1			
1942	1	13	0	N.A.	N.A.	N.A.
1943	4	45	17	6 813 300	10 182 900	0 8
1944	2	10	5	N.A.	N.A.	N.A.
1945	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
1946	4	20	21	8 254 200	12 611 800	8 0
1947	6	24	18	7 594 400	15 380 800	5 4
1948	3	35	11	13 810 700	15 641 800	6 8
1949	4	43	14	9 564 000	14 250 600	7 0
1950	6	40	7	22 400 000	18 200 000	5 2
1951	0	0	0			

N.A. Not available.

SOURCE: *Annual Abstract of Statistics, No. 87 (1938-1949)*

Britain's Turbine Transports

Plane	First flew	In service	On order
Comet (Series I)	1949	1952	31—BOAC (8) CPA (3) UAT (3) RCAF (2) Air France (3) MoS (2)
Comet (Series II)	1952	1954-55	24—BOAC (17) BCPA (6), MoS (1)(authorities or an as tentative order)
Viscount	1948	1952	38—BEA and associates (30) Air France (12) Air Liaque (4).
Britannia	1952	1956	26—all BOAC.

of a mass production item than, say, a car, it takes more advantage of Britain's skilled labor and technical genius. The industry can see the income from aircraft exports more than doubling last year's £41 million in a fairly short time.

▶**Labor Pains**—The industry goes on to argue that today's labor problem, one of the biggest rearmament bottlenecks, can only be solved finally through a permanently expanded industry. National defense needs demand a permanently expanded pool of skilled aviation labor. Workers tend to shy away from aviation factories because of the great expansions and contractions the industry goes through every time there is a national crisis. Give them the chance of permanent employment in the industry and they will come in willingly.

Workers have only been trickling into the industry over the past year. The present force of 200,000 must be doubled if rearmament goals are to be met. The lack of a wage incentive, a severe housing shortage, and extreme measures taken by non-defense industries to hold onto the workers they have, all conspire to make this one of the government's toughest problems.

There are no signs yet that the present government can or will follow these suggestions. Basically, what they mean is a change of investment away from some industries, say textiles, towards aircraft manufacturing. That sort of thing takes time and a lot of political jockeying what with the super tight British economy.

The Tories have chosen to move labor through a studied policy of deflation which should really begin to show results this year. Meanwhile, spending on aircraft and engines in 1952 isn't likely to go up much beyond the 1951 figure of £223 million. Even if more money were available, it isn't at all sure that it could be spent. Evidence of this can be seen from the fact that so far U. S. officials, armed with a big chunk of off-shore purchase money, haven't yet been able to spend any of it in the British aircraft industry.

▶**Hard To Buy**—One thing the U. S. would like to spend money on is Canberras for NATO air forces. Officials have told the British that they will buy with dollars any Canberras that the British can produce over and above present schedules and within a reasonable period of time. But so far no deals have been concluded.

Timing is the trouble. The British haven't been able to say that they will be able to deliver enough Rolls-Royce Avons for an increased Canberra output by 1954. One of the big reasons is that some key machine tools ordered from the U. S. for the Avon program aren't scheduled for delivery before 1954.

U. S. officials in London are trying now to get these delivery dates speeded up. Meanwhile, Rolls Royce will add two new production lines at Glasgow this year to supplement current production at Derby. In 1953, D. Napier & Sons, Bristol Aeroplane, and Standard Motor Car Ltd., may all come on stream with Avons. These companies are shopping around in odd corners of Europe now trying to get the needed tools ahead of delivery from the U. S. They are meeting with some success. At the same time high policy in both the U. S. and Britain seems to be lengthening out the period of rearmament—all of which increases greatly the chances that the British industry will get some help through off-shore purchases from the U. S.

Today, Avon production is actually ahead of Canberra airframe production, but this isn't likely to last for long. In addition to English Electric, Canberras will be coming out of three more factories by the end of this year or early next—Short Bros. & Harland, A. V. Roe Ltd., and Handley Page.

All sorts of electronic equipment is, however, in short supply. Armstrong Whitworth N. F. 11 night fighters are now being delivered to the RAF minus the radar in their noses. Canberras are coming off the line short of many important electronic gear. The British electronics industry has some £76 million worth of unfilled orders on its books, almost twice the figure of nine months ago. But as in the aircraft industry itself, electronic firms are spending time on research and development at the expense of quantity production now.

▶**New Service Planes**—The tables on page 189 show that the services will get two or possibly three new aircraft into service this year. Of these the DH Venom II for the RAF and the Sea Venom for the Navy are the most important. The British rate the Ghost powered Venom highly, say it compares

favorably with the F-86 at high altitudes. It has a rate of climb of 9,000 ft./min. and a speed in excess of 600 mph. Venoms will be coming off Vampire 5 production lines at DH Chester plant this year and at Bristol Aeroplane early in 1953. The Venom will probably join the Meteor 8s and the Vampire 5s now flying in NATO air forces.

A Squadron of Hawker Sea Hawks is now forming for the Royal Navy. The plane is an interim model, fitting in until a sweptwing version of the Vickers Supermarine 508 or possibly the Vickers 541 Swift is ready to be the Navy's standard fighter. Only a few have been ordered. The Sea Hawk is still an improvement in speed, range and climb over the Vickers Attacker which formed the Navy's first all-jet operational squadron last fall. Top speed is in excess of 610 mph.

▶ **Improved Models**—This year will see some revisions in the new fighters unveiled last year. A new model Hawker P. 1067 with more sweep in the wings is expected, although some 500 of the original version have been ordered. There are no plans to order either the DH 110 or the GA5 in any quantity. A handful of each may be made, but it isn't likely that either plane will go into quantity production. One of the largest orders for any single aircraft is being placed for the Vickers 541 Swift, but delivery is still scheduled for 1954.

The recent crash of the prototype Vickers Valiant bomber doesn't appear to have delayed production. The company says it will have a second prototype flying by the end of March. The Valiant, ordered only in very small quantities, is set to join the Bomber Command in 1954.

Both the RAF and the Navy will be doing their best to swell their ranks with pilots and aircrews this year. The RAF now boasts about 20,000 officers and 140,000 men plus 91,000 national servicemen (draftees). Another 20,000 make up the Royal Air Force Volunteer Reserve and the Royal Auxiliary Air Force.

The Navy's carrier strength at the beginning of 1952 was 13 including HMS Eagle which was commissioned last year. Of this number seven are fleet carriers of 23,000 tons and up, and six are light fleet carriers. By completion of the current building program in 1954 total strength will be eight fleet carriers and 11 light carriers.

The size of the British air forces plus the production outlook point up better than anything that British air power is still geared to salvation through research. But this year is the crossroads. There is not much time left to translate research into revenue and defense. The industry knows a lot of its members may go under unless the challenge is met.

Canada: Factories Full, RCAF Growing

- **Dominion concentrating on defensive highspeed fighters; so Sabre and Canuck get priority.**

- **Production of both is well along, but suffering from same bottleneck felt in U.S.—engines.**

Canadian military aviation is getting into its stride, and civilian aviation is continuing to expand.

Canadian aircraft plants today are mainly busy with military production, have passed the tooling-up stage and fighter planes are coming off the production lines.

The Royal Canadian Air Force is well on its way to reaching its prepared ness peak, and has already dispatched units to Europe to stand with the North Atlantic Treaty Organization forces.

The commercial airlines have placed orders for larger transports in both England and the United States and are planning expansion of their domestic and international services.

That, in brief, is the picture of Canadian air power as the Dominion once more mobilizes its manufacturers, its military forces and its airlines to work with the U. S. and the U. K.

Canadian Aviation Expenditures[1]

Year	RCAF	Defense Research Board-Air	Department of Transport Air Services Branch[2]	Department of Trade and Commerce[3]
1946–47	$30 297 370	$1 183 786	$34 399 335	
1947–48	48 232 530	368 616	42 094 633	
1948–49	90 199 790	6 963 687	55 882 256	$2 000 000
1949–50	[4] 224 892 960	19 214 707	28 404 830	1 500 000
1950–51	[5] 550 490 395	9 066 509	N A.	[6] 4 500 000
1951–52	[5] 620 000 000	N A.	N A	N A

[1] Excluding capital investments.
[2] Including maintenance and operation
[3] For research and development of jet engines and aircraft.
[4] Including expenditures on military aircraft.
[5] Department of Reconstruction and Supply
[6] Estimate which includes $4 000 000 for jet fighters $90,000,000 for repair and upkeep.
NOTE: Figures are in Canadian dollars.

Canadian Airline Operations

Year	Aircraft miles flown (000)	Passengers carried	Passenger miles (000)	Freight (tons)	Freight ton miles (000)	Mail (tons)	Mail ton miles (000)
1940	11 013	149 025	41 159	7,118	948	1 358	616
1941	19 505	308 058	86,724	8,290	1,126	1,706	895
1942	13,329	226 047	73 209	6,326	1,274	9,736	1,464
1943	15 244	314 582	103 340	6,927	1,715	3 732	3 104
1944	16,189	403 038	113 386	7,218	1 999	3 648	3 672
1945	20,087	525 407	104 163	7 231	1 050	3 510	2 981
1946[1]	28 369	833 640	215 548	19 057	3 303	2 965	1 835
1947*	26,000	893 171	267 645	17,121	3,070	3 453	1 640
1948*	38 534	1 103 798	342 036	15 631	3 458	3 055	2 861
1949	37 747	1 102 965	418 569	18 569	5 313	3 733	4 308
1950	41 368	1 311 021	499 581	23 341	6 079	7,126	4 253
1951[1]	21 841	852 923	274 333	14 299	4 720	3 994	2 262

*Excludes figures for non commercial aviation
[1] First six months, January–June inclusive

SOURCES: *The Canadian Year Book, Dominion Bureau of Statistics (for 1951)*

Trans-Canada Airlines Operations

Year	Aircraft miles flown (000)	Passengers carried	Passenger miles (000)	Freight (tons)	Freight ton miles (000)	Mail (tons)	Mail ton miles (000)	Undupicated route mileage
1947	19,244	432 783	240,178	1,945	1 257	1,080	1,081	21,073
1948	21 472	535 376	350,110	2,650	2 582	3,214	2,980	10,181
1949	21 595	555 056	800 412	2 505	3 643	4,044	4,190	10 385
1950	21 516	623 000	454,700	3,078	3 324	4,450	4,443	10 834
1951*	25 000	680 000	N A.	N A.	3 730	N A	4,790	N A

*Preliminary figures NA Not Available

SOURCES: *Trans Canada Airlines, International Civil Aviation Organization, Digest of Statistics No 18 (for freight and mail tonnages only)*

The Plants

Canadian aviation factories are located mainly in the Toronto and Montreal areas, with some overhaul and parts plants scattered throughout Canada.

▶**Canadair**—At Montreal, Canadair Ltd., subsidiary of Electric Boat Co. of New York, is now busy with orders totaling unofficially $500 million. This includes 500 T-33 Lockheed jet trainers for RCAF at $100 million, an order for an unstated number of F-86 Sabre jet fighters for RCAF at about $300 million, and an order from the U. S. for 300 Beechcraft T-36 advanced trainers at $100 million.

Of these orders, production is well on the way for the Sabres, while the trainers are expected to be in production soon at expanded quarters at the Canadair plant. Canadair will soon have more than 12,000 workers.

Production of the F-86 Sabre is by latest official announcement at Ottawa about 20 a month, but this could be stepped up to 150 a month when engines become plentiful. About 20 Sabres were reported off the assembly line at end of 1951. Engine shortages are holding up production. At present the General Electric J-47 engine is being imported from the U. S., but the Avro Orenda jet engine will power the plane when production of these engines gets underway at Toronto.

▶**Engines**—At Montreal, two engine plants are now readying production. Canadian Pratt & Whitney has started building a plant to make its R-1340 Wasp for the North American Harvard trainers being built by Canadian Car and Foundry Ltd., at its Montreal and Fort William, Ontario, factories. It is understood that 1,000 of these trainers have been ordered by Canada at a cost of about $65 millions. The same company built these planes during World War II, and it is believed that some have been ordered for the U. S.

The other engine plant at Montreal is being built by Rolls-Royce of England to produce 1,000 Nene engines for the T-33 trainers. Plant and engines are unofficially stated to cost about $250 millions. No date has been set yet for production to start.

In addition, there are a number of subcontractor firms, aviation radio equipment manufacturers, and overhaul plants at Montreal.

▶**Avro**—At Toronto, major effect is at A. V. Roe Canada Ltd., where the CF-100 Canuck twin engined jet fighter and the Orenda jet engine are now getting into production. No figures have been released on actual production of the CF-100, first of which was turned over to the Royal Canadian Air Force late last fall. New production chiefs have been appointed at the plant which has been on experimental work on the CF-100 and the Avro Jetliner transport until recently, and all effort is now being concentrated on the fighter. Employment now is above 10,000 and will increase.

The factory for the production of the Orenda engine is now almost complete and production is expected to be underway by summer. Currently, a small assembly line for the Orenda is being operated at the plant where the CF-100 is coming off the production line. The Orenda will power the CF-100 as well as the F-86 Sabre.

Work on the Jetliner has been postponed for the present.

▶**De Havilland**—At Toronto, also, de Havilland Aircraft of Canada Ltd. is busy with an order for 109 of its post war single-engine Beaver transports for the U. S. at $3,500,000. This plane is being used widely throughout Canada for bush operations and has been exported to South America and Scandinavia.

A larger version, the Otter, seating 14 passengers and also usable as an ambulance plane, has been test flown and is expected to go into production soon. Production of Beavers is about ten a month. Company also has a postwar trainer, the Chipmunk, which it has built for RCAF.

At Toronto and vicinity there are many supply firms now in operation, established in past few years specifically to make parts for the Orenda jet engine, only engine developed in Canada. Other aviation equipment makers, such as Irving Air Chute Co., at Fort Erie, are located in the Toronto area.

▶**The Cost**—The Canadian government, according to official statements made in recent months, has spent $29 million on development of jet aircraft

and engines. Of this $21.5 million was spent on the Orenda engine, almost $7 million on the CF-100 Canuck, and almost $1 million on the F-86 Sabre. In addition, the government has spent $6.5 million on development of the Avro Jetliner, while Avro spent $2.3 millions on this job.

During the fiscal year 1950-51 (ending Mar. 31) the Canadian government spent $330.5 million on new aircraft. In the fiscal year 1951-52 about $400 million will have been spent on new planes and about $90 million on repair and upkeep.

The Canadian aircraft industry expects to have about 25,000 people at work in its plants before the end of 1952 as production really gets rolling on aircraft and engines.

The Air Force

The Royal Canadian Air Force by latest official reports had at least six fighter squadrons in active operation. At least one was stationed in England under NATO command. Two more squadrons were slated to go overseas at an early date to make up the first Canadian fighter wing overseas under NATO. Eleven squadrons have been promised by 1954.

▶**Plans And Organization**—The RCAF has plans for 40 squadrons by 1954. Of these 28 are to be fighter squadrons. The remainder will include para-rescue section, anti-submarine and coastal squadrons, transport squadrons, photographic squadrons, and training squadrons. The service strength is expected to be 45,000 officers and men by 1954, with about 3,000 aircraft.

Currently RCAF is made up of five commands. These are the training command, with headquarters at Trenton, Ont.; northwest air command with headquarters at Edmonton, and having under it the tactical group at Winnipeg, a group at Vancouver, and the Maritime group at Halifax, which reports directly to Ottawa, the air transport command out of Ottawa, the air materiel command, and the defense command both with headquarters at Ottawa.

Of the non-fighter squadrons, there are the Maritime anti-submarine and coastal patrol squadrons using converted Lancaster bombers on the Atlantic coast, three transport squadrons two of which use Dakotas on domestic service and one uses DC-4 North Stars on international service, and three photographic squadrons.

In the past year the RCAF "Thunderbird" squadron provided airlift service out of McChord Field, Tacoma, Washington, to Korea. This service now operates out of Dorval, Quebec, near Montreal. Twelve North Star air

craft with 14 crews and a complement of 400 men stationed at Tacoma flew 14 million miles in 11 months on UN operations to and from Korea.

▶ **Strength**—Planes on hand by RCAF by latest official statements include 50 de Havilland Vampire jet fighters, used mostly by reserve squadrons, 100 Mustangs bought from the United States, 48 Lancasters, 24 North Stars, 80 Dakotas, 200 Harvard and 50 Beechcraft trainers, 12 Canso Flying boats, and a number of miscellaneous planes.

In the past year Canada bought 100 Mitchell bombers from the United States, 48 Fairchild C-119 transports ($38.6 million), six Piasecki troop carrying helicopter transports ($2.4 millions), one Sikorsky S-55 helicopter, three Bell helicopters, 29 Dakotas, and has ordered three British Bristol freighters, two British de Havilland Comet jet transports, and 180 Beechcraft Expediter trainers.

The RCAF is concentrating its operations on fighter commands, and has no bomber commands or squadrons. It feels that its role is best in the fighter field because of Canada's vast, sparsely populated areas. Its fighter squadrons will all have Sabre or Canuck aircraft, with 25 aircraft per squadron, and one new squadron being readied each month this year if possible.

Strength late in 1951 was about 27,000 officers and men, with a recruiting quota of 1,200 a month including 100 aircrew, 800 groundcrew and 300 air women. Canada has no conscription or draft.

The Airlines

Canadian civil aviation consists of two major airlines, Trans-Canada and Canadian Pacific, a couple of smaller scheduled airlines, a large number of charter and nonscheduled operators, private mining and development air transport companies, a number of provincial government air services, and a number of flying schools.

All of these had a good year, and expanded operations. Civil aviation comes under the Canadian Air Transport Board and the Department of Transport, both headquartered at Ottawa. The CATB licenses and regulates all airline companies, the DOT operates airfields, radio and meteorological services through its air services division.

The CATB constantly holds hearings for new licenses, changes in services of operating companies, from the largest to the smallest, and also handles applications of international air services flying over Canada with stops at such Canadian airports as Gander, Goose Bay, Montreal, Toronto, or Edmonton.

The DOT licenses all flying person-

fuel and air engineers, as well as aircraft and private airfields.

▶**The Big Operators**—Both Trans Canada and Canadian Pacific in the past year increased their international services and have plans for further expansion. TCA now flies to Paris as well as Great Britain, and likely will begin service to The Netherlands, Scandinavian and other European countries as a result of airlines from these countries now landing at Montreal. TCA will receive five Super Constellations next year for its trans Atlantic services which it now operates with DC-4M North Stars.

CPA has extended its Australasian routes to include stops in New Zealand, it is expected to speed up its service late this year when it hopes to have delivery of two de Havilland Comet jet transports for its trans-Pacific services.

It has in the past year also operated an airlift service for RCAF to Korea as part of Canada's contribution to the air operations under UN assistance to Korea.

▶**The Bush Boys**—Smaller operators have been purchasing modern planes mostly in the United States and gradually replacing some of the war surplus planes used on bush and mining operations. Largest of these other operators is the Ontario Provincial Government Air Service, with 40 Beaver aircraft for firefighting and forestry patrol operations.

Research by this organization has developed new methods of stopping forest fires from the air in the early stages of the fire by dropping salvos of five gallon containers of water on the small fires.

A great deal of Canadian civilian aviation is in the hauling of mining and development equipment to new sites of natural resources. Thus much of the work in developing the vast new iron ore fields in Labrador and northern Quebec has been done by aircraft which have transported heavy mining machinery, bulldozers for roadbuilding, jeeps, as well as men and food. The U. S. government even lent a Fairchild transport to one company for summer operations in the Labrador region. This same type of work is carried on throughout Canada.

—James Montagnes

Seating in the Rear

Trans Canada Air Lines cannot permit fare-paying passengers to occupy flight deck seats in its DC-4M North Stars, the Department of Transport, Ottawa, has ruled. These seats may be occupied only by TCA employes or technicians of other companies working with TCA with the authorization of the Canadian Air Transport Board.

Australian Department of Air Budget

Year	Aircraft equipment & stores	Defence research & development	Maintenance	Acquisition of sites & buildings	Total
1947-48	£8 424 589	£5 941	£297 698	£1 88 993	£19 541 345
1948-49	9 652 253	2 000	991 288	—	10 000 589
1949-50	1 000 992	91 917	564 230		11 903 255
1950-51	10 210 200	6 000	765 187	48 747	27 374 139
1951-52	92 000, 000	100 000	950.000	400,000	42 703, 800

NOTE: Australian pound quoted at $2.24. Budget given in partial detail.
[1] Fiscal year ends June 30.
SOURCE: The Budget

Australian Airline Operations

Year[1]	Aircraft miles flown (000)	Revenue passengers	Revenue passenger miles (000)	Freight (tons)	Freight ton miles (000)	Mail (tons)	Mail ton miles (000)
1944	10 625	210 943	105 979	1,481	810	3 660	2 335
1945	14,421	325 914	155 000	2,000	1 400	4 450	2 445
1946	21,934	515 892	257, 816	5,000	3 065	2 980	3 360
1947	25,350	581 702	451, 575	10,850	7 640	1, 743	3 000
1948	33, 931	1 248 000	626 172	24, 500	16 000	2,078	4 190
1949	43 224	1 490 918	910 907	38, 000	10,360	2 350	3 488
1950	48 267	1, 550 645	755 000	40,800	20 250	3 479	5 175
1951[2]	43 030	1, 705 553	000 004	38 531	27 102	N. A.	1 543

[1] Figures as of June 30 annually.
[2] 1951 figures cover domestic air transport services only. N. A. Not available.
SOURCES: Quarterly Summary of Australian Statistics, Department of Civil Aviation, for 1951

Australia: Air Power Increasing

- Lack of money and manpower is troubling aviation industry, but UK pushes for expansion of facilities Down Under
- Obsolescent B-29s, Mustangs, Vampires and Meteors make up RAAF; expect home-built jets by next year.

By Morcel J. Grobtuch
(McGraw-Hill World News)

Melbourne—From many points of view 1951 was a record year for Australian aviation, but indications point to even increased activities in 1952. This applies both to the military and civilian aviation.

The importance attached to the development of aviation in Australia is growing almost daily. The actual development is, of course, gravely hampered by the hard currency shortages which alone stand in the way of a large increase in the number of military and civilian aircraft.

Continued inflation and an acute shortage of skilled manpower has also an effect on the various expansion programs and particularly on the numbers of people available for flying, servicing and manufacturing operations. It seems now that steps taken by the government to weaken the inflationary movements may have a good effect on the availability of manpower and resources for work in aviation.

▶The First Line—Strong pressure is now being exercised on the Government to accord first priority to military aviation and to make it the principal defense force of Australia. At any rate it is certain that military aviation will be expanded in 1952 and its growth controlled only by the availability of aircraft from abroad and the manufacturing capacity within Australia itself.

Present aircraft of the RAAF are largely obsolete, and as a result of past negligence, the total planes at the disposal of RAAF is now below 500. This includes obsolete trainers.

Australian airmen were the first to join their U. S. colleagues in the Korean fighting and have again proved their ability, although the aircraft they are

flying in Korea are not of the most modern design.

▶ **The Planes**—Lincoln (B-29) bombers are still the mainstay of Australia's bomber force. As far as fighters are concerned, there is nothing better available than Mustangs, Vampires and Meteors.

This is unlikely to change much in 1952, but by 1953 Australia may start receiving home-built Canberra jet bombers and Sabre fighters powered by Rolls-Royce engines.

For anti-submarine work Australia will use Lockheed Neptunes, two of which have already been delivered and are currently being tested. Satisfactory tests will mean further orders. A decision is expected soon on the type of troop transport plane to be purchased in quantity for Australian forces. Strong preference is being shown for U. S. aircraft, and the C-119 may be selected for the initial order. More helicopters will be purchased if available for early delivery, as reports from Korea on their utility have impressed Australian planners.

The pilotless jet target plane may be produced in 1952 in some numbers and first deliveries of modern trainer planes should come through.

▶ **Where to Buy?**—The great problem is where to buy the planes. Most experts favor the U. S. types. But British manufacturers consider Australia their market and view with considerable dissatisfaction every Australian purchase in the United States. Arguments that scarce dollars are being used for purchasing planes that could be bought instead in the United Kingdom have been heard on several recent occasions. But Australian experts say that in case of war Australia would depend on American spare parts and aircraft and that it is better to prepare for such a possibility.

At the beginning of 1952, last orders for Lincoln and Mustang planes had been completed and no more of these planes will be produced in Australia. Tooling up is taking place for the production of the Sabre jet which will boast the original U. S. airframe, a British high-powered engine and a host of Australian-designed additions and features which are claimed to make the jet more powerful and better than the U. S. Sabre. Some work in this direction is still going on.

Also to be produced in Australia is a local version of the Canberra. Initial orders are for 72 Sabres and for about 48 Canberras but there is a move to double these orders.

The CA-22 trainer will come into mass production with an initial RAAF order for 65. Foreign interest has been shown in this Australian-designed and developed trainer. At Bankstown, New

South Wales de Havilland will produce a jet trainer.

►**Expansion Plans**—Considerable expansion of aviation manufacturing capacity is being asked of Australia by the United Kingdom.

Australia has been notified, in effect, that the United Kingdom will not be able to supply her with many planes in case of war, because its own needs and those of its European Allies would prevent any large shipments to Australia. Moreover it is the opinion of United Kingdom authorities that Australia should not only provide for herself but should also take care of at least some requirements of the Allies of Western Powers in Southeast Asia and the Far East.

Implementation of this aim will not be easy. It would mean a quick importation of a very considerable quantity of tools and equipment from the United States and probably also some form of compulsory manpower direction. Even now some limited Australian production goals are handicapped by the difficulty in obtaining manpower—it numbers no more than 9,500 persons in aviation manufacturing, compared with some 40,000 at the height of World War II.

Production of aviation equipment and parts will be increased in 1952. Among notable additions will be a partnership of Bendix International with a large Australian manufacturing concern.

►**Transport Growth**—All records have been smashed in 1951 by the Australian air transport companies and it looks as if 1952 will bring further records. Figures show increases, some of them large, for every sector, but particularly for air freight. The popularity of air freight in Australia is terrific.

The chief problem is aircraft replacements. Australian airlines are studying the possibility of putting jets on their internal flights, but opinions on the advisability of doing so are rather divided. At any rate no jets have been ordered, but orders have been placed for Super Constellations and for Viscounts, the latter for the Government airline. Qantas' decision to go for American planes was prompted by KLM's competition using U.S. transports.

Most of the Australian airlines would like to purchase new aircraft but here again hard currency restrictions and uncertainty as to the extent of government airline's competition are preventing early decisions.

The Australian National Airways is threatening to go out of business if the government doesn't sell its airline or at least merge it with ANA. Government promises of equal treatment to ANA and a share of mail contracts, etc.,

have been refused by ANA. At the same time Ansett Airways is continuing to undersell both airlines with cuts amounting to 25% of fares. Ansett is pushing air coach.

Australian airlines continue to serve large parts of the country where services are highly uneconomical. And foreign experts agree that service level of Australian airlines compares favorably with foreign airlines.

▶ **Research**—Aviation research in Australia is mainly limited to navigational aids, ground equipment, etc. Several useful aids such as the distance measuring equipment and the microwave navigational system have been developed by scientists of Commonwealth Scientific & Industrial Research Organization. These developments created considerable interest abroad.

A joint British-Australian project at the South Australian Experimental Rocket Range at Woomera is steadily progressing, though the results are on the classified list.

▶ **Lightplanes**—Private flying activity is hampered by lack of suitable planes at reasonable cost. British and Continental types are expensive and do not always correspond to what the Australian users would like to see in their planes. American planes do not reach Australia because of imports ban on dollar paid planes. Nine Aero Clubs claim 42,000 hours of flying in 1950-51; instruction is provided at over 50 centers. This will be broadened in 1951-52. Flying hours should then exceed 50,000 a year. But the Aero Clubs complain that they can't get a suitable training plane at reasonable cost.

Use of aircraft for agricultural work is quickly developing and 1952 should witness increased activity in this field.

Expansion Planned

(*McGraw-Hill World News*)

Melbourne—Proposals for a major British aircraft producing firm to transfer to Australia and for a United Kingdom subsidy of an expanded Australian aircraft industry are being discussed between London and Canberra and an early decision is expected.

▶ **Regional Base**—These discussions are reliably understood to be linked with an Allied program to make Australia a major regional defence supply base.

The proposal to transfer a major U.K. aircraft plant to Australia was first made to the previous Socialist Government of Australia but the Socialists refused to guarantee that the manufacturer's activities would be free of Government control. The present Government is viewing the matter very favorably.

British subsidy to new aircraft plant in Australia may take one of several suggested forms.

French Air Budget—Partial Detail

Year	Department	Equipment	Subsidies	Regular Budget Total	Grand Total[1]
			(In millions of francs[2])		
1948	Civil & Commercial Aviation	762.0	885.0	4,193.0	8,619.0
	Armed Forces — Air	9,019.0[3]	10.0	23,534.0[3]	43,220.0[3]
	Armed Forces — Total	70,653.0	1,016.0	175,851.0	218,490.0
1949	Civil and Commercial Aviation	1,234.0	1,201.0	5,657.0	19,196.0
	Armed Forces — Air	10,084.0		28,234.0	57,825.0
	Armed Forces — Total	194,650.0	230.0	215,245.0	288,718.0
1950	Civil & Commercial Aviation	1,603.0	1,886.0	7,442.0	10,557.0
	Armed Forces — Air	13,377.0	58.0	34,310.0	71,183.0
	Armed Forces — Total	197,290.0	350.0	262,186.0	388,782.0
1951[4]	Civil & Commercial Aviation	80.3	400.0	12,382.0	18,774.5
	Armed Forces — Air	24,152.0	88.0	47,997.3	123,425.2
	Armed Forces — Total	181,408.0	16,891.3	420,526.0	571,409.0

[1] Grand total includes supplementary budget for reconstruction and equipment computed Jan. 31 of following year.
[2] Includes air occupation expenditures.
[3] Estimates based on expenditures of first nine months.
[4] The franc is quoted at $.00286. At this rate, 1951 air forces grand total of 123,425,300,000 francs is equivalent to about $352.8 million.

SOURCE: Journal Officiel de la Republique Francaise.

French Air Power Gets Off Deck

- **From a postwar position of nearly zero, and despite money troubles, French air will soon pull its weight in NATO.**
- **But good-looking fighters, trainers, transports may have to buck planners' desire for standardization of equipment.**

By Ross Hazeltine
(McGraw-Hill World News)

Paris—French air power, reduced to near zero by the war, is on the way back up and climbing steadily. France now is capable of making a substantial contribution to the air defense of the West.

This year will bring new gains in French military air strength and in airframe production. It also will raise new problems and complicate some old ones, chief among which is the old ghost that perennially haunts the French aviation industry—money.

France has the skilled engineers, the labor force, the plant capacity and the proven designs to do a sizeable aircraft production job. But the industry is seriously handicapped by lack of funds.

The French government, tugged and shoved in six different directions by the warring political groups of the national assembly, never has been able to scrape together the money for a substantial production program. The French aviation industry has been confined largely to building prototypes.

▶ **Program Begins**—This year, a long-planned and often delayed program of French combat aircraft production will get underway. The first of an order for 350 Marcel Dassault Ouragans a trim, competent little fighter, already have been delivered to the French Air Forces. Production is scheduled to rise steadily.

And the Mistral, French version of the British Vampire, is being produced in quantity under license by Societe Nationale de Constructions Aeronautique du Sud Est (SNCASE). The exact number on order is secret.

This start on a combat aircraft production program is sure to put new vigor in the old money ghost. In January, Premier Rene Pleven's government fell from office in an attempt to provide funds for an expanded defense program by raising taxes and economizing other government expenditures. Other governments aren't likely to find the going much easier. There is a distinct possibility that production schedules will have to be cut back.

▶ **Too Many Types**—For the North Atlantic Treaty Organization, appearance of the Ouragan and the Mistral in combat units of the French Air Force will raise a different problem. NATO air forces already have four standard fighters—the F-86, F-84, Meteor and Vampire. NATO has found that it's no simple job to handle even that many fighters and develop, at the same time, the flexibility of operation that all officers consider essential.

The West's air officers would like to

work toward standardization of equipment. They are convinced that, as a minimum, every NATO airfield must be equipped to fuel and provide first and second echelon maintenance for every type NATO plane. Obviously, each increase in the number of fighters in service complicates this problem and tends to raise the cost of achieving the necessary flexibility.

So NATO leaders are saying with growing conviction that soon the nations of the western alliance are going to have to agree to greater coordination in their military procurement programs. That won't be easy. It may take a long time, but it's sure to be an important influence in the future development of the French aviation industry.

The possibility of an eventual agreement among the western nations on who should make what equipment seems too far in the future to have much effect on French aviation this year. French air power is likely to continue its slow but steady growth through 1952. Here's how prospects shape up.

Military

The French Air Forces will gain weight this year. They will be beefed up by growing American aid through MDAP, by a beginning trickle of French built planes and by a small increase in manpower strength. France also stands to gain considerably from NATO's airfield construction program in Western Europe.

▶**U. S. Aid**—Deliveries of F-84s to the French Air Forces under MDAP reached substantial volume only toward the end of last year. Figures are secret, but there's no doubt American aid deliveries now are on a scale to provide a big jump in the combat effectiveness of the French Air Forces by mid-year.

The U. S. also is helping in France's flight training program. France provides basic flight training for officers at her Ecole de l'Air, near Marseille, the West Point of the French Air Forces. After graduation, pilots go either to the French advanced flight training center at Meknes in French Morocco or to North America for advanced training at U. S. or Canadian fields.

The Air Ministry is trying to build up strength in trained manpower by an Air Forces recruitment program, improved training methods and, especially, an expansion of reserve training facilities for pilots, navigators, gunners, radio operators and bombardiers. At the end of 1951, the French Air Forces counted 91,000 officers and men on active duty. Staff plans look for an increase in strength to over 100,000 this year, but how big the increase will turn out to be will depend on these two factors:

- How much the national assembly finally appropriates for defense and what share of the total the Ministry of Defense hands over to the Air Forces. Last year, the Air Forces got 140 billion francs ($400 million) out of a total defense budget of 740 billion francs ($2,114.3 million). Budget increases not yet approved by the national assembly may give the Air Forces about $500 million to spend this year.
- How much France's steady creeping inflation cuts into the buying power of the funds appropriated. This is an important factor; it often forces some cutbacks in scheduled programs toward the end of the year.

▶**Airfield Program**—Gen. Eisenhower's recommendations to NATO call for the construction of some 50 airfields in France at a cost that probably will run as high as $750 million with complete equipment in place. The construction will be paid for under the NATO infrastructure agreement.

Even though this program may have to be reduced somewhat for cost reasons, it still will represent a substantial new asset for the French Air Forces as well as for Lt. Gen. Lauris Norstad's Allied Air Forces, Central Europe. It will provide the bases for a considerable future expansion of the French Air Forces, should that become necessary and possible.

French Airline Operations, 1946-1951

Year	Aircraft miles flown (000)	Passengers carried	Passenger miles (000)	Freight (tons)	Freight ton miles (000)	Mail (tons)	Mail ton miles (000)
1946	N. A.	347,814	235 000	N. A.	11 090	N. A.	N. A.
1947	N. A.	488,115	300 500	28 200	15 430	N. A.	N. A.
1948	N. A.	774 090	440 200	35 900	20 180	5 030	6 800
1949	39 620	921 341	515 000	42 000	25 000	5 940	7 780
1950	47 300	1 118 170	602 000	48 800	27 800	7 350	8 000
1951	N. A.	[1] 1 227 300	[2] 1,100 000	451 200	[2] 50 100	[2] 8,815	[2] 10 880

[1] Estimate. [2] Air France only. N. A. Not available.
SOURCES: Bulletins Mensuels de Statistique; Air France.

Air France Operations, 1947-1951

Year	Aircraft miles flown (000)	Passengers carried	Passenger miles (000)	Freight (tons)	Freight ton miles (000)	Mail (tons)	Mail ton miles (000)	Unduplicated route mileage
1947	16,500	420 115	372,000	7 920	5 555	5,335	4 850	N. A.
1948	22,500	575 472	515,500	15 980	12 880	5,900	5 940	N. A.
1949	25,000	690 998	620,000	23 450	16,000	5,480	7 730	N. A.
1950	26,900	774 300	705,900	28,950	20,000	7,000	8 720	N. A.
1951	31,870	850 900	857,500	39 315	30 900	8 815	10 850	78 294

N. A. Not available.
SOURCES: Bulletins Mensuels de Statistique, Air France.

Production

French Air Force squadrons will get French-designed and French-built combat planes this year for the first time since the war. The Ouragan, powered by a Hispano Suiza Nene, is scheduled to come off the production line at the rate of 12 a month until the end of September. Then, the figure will jump to 18 a month, and, in January, 1953, production of Ouragans is slated to reach a total of 30 a month.

▶**The Mystere**—Dassault also is tooling up for production of his MD452 Mystere. The Air Forces have ordered 340. The version to be produced is a single-seat fighter to be powered either by a Hispano Suiza Tay or by the new improved Atar 101 which develops more than 6,000 lb. takeoff thrust. The Atar is built by Societe Nationale d'Etudes et de Constructions de Moteurs d'Aviation (SNECMA), the nationalized French aircraft engine manufacturer.

The French are close-mouthed about the Mystere but they don't try to conceal their pleasure at the performance of prototypes in tests. On the basis of reliable reports, it is probable that the Mystere with either the Tay or the Atar will be capable of supersonic speeds, will have an excellent rate of climb and will stand at least equal to the best planes yet built in maneuverability at high altitudes. When the Mys

tere will finally go into production is a good question. There again the money problem will be the determining factor.

SNCASE is building Vampires powered by imported Goblin engines at a rate of about 20 a month and is getting into full production of the Mistral, powered by a Hispano-Suiza Nene, which will replace the Vampire. The Mistral is reported to be faster than the Vampire and to have a better rate of climb. About 150 Vampires have been built so far, the first deliveries of Mistrals to the Air Forces was made in January this year.

▶ **Transports**—Half a dozen transports are in production. Marcel Dassault has an order for 300 of his MD315, a two-engined military transport. Societe Nationale de Constructions Aeronautique du Nord (SNCAN) is building 175 of its two-engined medium transport, Nord 2501 under government order. The first deliveries are expected about the end of this year.

SNCASE is building eight of its big Armagnac, four-engined commercial transports for Air France. The third of these planes to be completed made its first flight in January. The others are scheduled to be completed and delivered before the end of the year.

Louis Breguet, with Dassault the biggest of the private plane builders has orders for 15 of his four-engined two-decker, the Breguet 76 Deux Ponts. Twelve of these planes are for Air France and are expected to be in service this year. The Air Forces may place an additional order.

Societe Nationale de Constructions Aeronautique du Sud-Ouest (SNCASO) is building a pair of good twin engined medium transports the SO 30P Bretagne of which 40 have been ordered and a number already delivered and the SO 95 Corse of which 60 have been delivered to the French Navy.

▶ **Trainers**—Societe Industrielle pour l'Aeronautique (SIPA) has orders for 184 of its 111, 11 and 12 trainers. A number have been delivered. SIPA also is building 100 SIPA 901s, a two-place lightplane, under government order for French Air Clubs and is testing the first prototype of the world's first jet light private plane, the SIPA 200.

Morane-Saulnier is completing an order for 500 of its MS 472, 474 and 475 military trainers. The company now is working on an order for 40 of its newer MS 732 and 733 two-seat trainers.

Finally, Societe de Construction Aero-Navale (SCAN) has completed delivery to the French Navy of 25 SCAN 20s, a seaplane trainer. SNCAN is producing 25 of its twin-engined Nord 1400 seaplanes, and a number of the smaller aircraft builders are pro-

ducing a small number of lightplanes under government order for the French Air Clubs.

French aircraft production this year also will include some building of foreign planes under license. SNCASE is planning to build the British Venom for the French Navy. And there are well-founded reports that SNCASE is negotiating with de Havilland for an order to build the Comet, perhaps powered with Hispano Suiza engines, for delivery in Britain.

In addition, the possibility that one of the three nationalized French constructors may be licensed to build a Sikorsky helicopter of eight or twelve seats for the French Army is under study.

Air Transport

French commercial airlines could make a substantial contribution to any future airlift operation, if necessary. The French commercial air fleet of some 250 planes, half of them belonging to Air France, now regularly fly well over 50 million miles a year, mostly in American built Constellations, DC 4s and DC 3s.

In addition to Air France, there are a dozen major privately owned airlines flying mostly within France and between France and French North Africa. Air transport is a growing industry in France as in the United States, and the French airlines are counting on breaking all records this year, both in numbers of passengers and in weight of freight hauled.

Air France, the giant of the French air transport industry, is able to operate at a small but respectable profit despite rapid expansion of its services and so is in a good position to hold its own against foreign competition. Air France will begin trans-Atlantic tourist rate service on May 1 with two weekly flights and increase the number to five flights a week during the peak summer travel period.

Private Flying

Private flying is a popular sport in France, thanks mostly to the government's efforts to develop "Esprit Aeronautique" among French youth. The Service de l'Aviation Legere et Sportive, a government agency under the Ministry of Transport, has provided 1,100 lightplanes, 1,400 gliders and 180 full time government-paid flight instructors to the 125 Air Clubs grouped in the Federation Nationale Aeronautique.

A qualified French boy of 17 or 18—not yet old enough to join the French Air Forces—can receive free flight training with SAILS equipment and instruc-

tors by promising to take his military service in the Air Forces.

Last year, 1,154 first degree pilots licenses—for 15 hours of flight training—were awarded, and 412 second degree pilots licenses—for 30 hours of flight training—handed out. Altogether SALS figures its facilities enabled Frenchmen to fly a total of 107,071 hours of powered flight and 54,299 hours in gliders last year.

In addition to the SALS planes, the Air Clubs themselves own 483 light planes and 395 planes in France belong to individuals.

Research

The most exciting aeronautical research now going on in France is probably Rene Leduc's work on ramjets. Nobody will talk much about Leduc's progress. He is working under a government research grant in close contact with the Air Forces.

But despite the stern official silence, there is solid reason to believe that Leduc now has built three prototypes of his piggy back ramjet, the Leduc 01, and that recently one of them has exceeded the speed of sound at high altitude. Leduc now is reported trying to devise an auxiliary power unit that would allow the ramjet to take off from the ground.

Other research is carried on by the state-owned company, Arsenal de l'Aeronautique. Arsenal maintains a supersonic windtunnel near Paris and has plants at Lyon and Strasbourg as well as Paris. Arsenal doesn't go in for production; it builds prototypes for research and for testing. After proving, an Arsenal design may be turned over to one of the nationalized constructors for production.

The French government agency, the Direction Technique et Industrielle, is in general charge of the various other government aeronautical research organizations. The Service Technique Aeronautique deals with design contracts; the Office National d'Etudes et Researches Aeronautique conducts some basic research and provides technical information; two flight test centers—one at Bretigny near Paris and the other at Marignane near Marseille—are available to all aircraft producers, and the government maintains a number of windtunnels which are at the disposal of all manufacturers.

Some of the most interesting of the prototypes now under study in France are the Rev 01, a plane with articulated wings; the Hurel Dubois HD 10, whose very high aspect ratio wing has given the plane excellent performance in tests; the SO 1120 Ariel III jet helicopter and the series of light jets built by Fouga and SIPA.

Scandinavian Airlines System Operations

Year	Aircraft miles flown (000)	Passengers carried	Passenger miles (000)	Freight (tons)	Freight ton-miles (000)	Mail (tons)	Mail ton-miles (000)	Unduplicated route mileage
1947*	3 790	44 066	72 000	353	1 285	290	900	N A
1948**	4 810	66 784	104 500	488	1 900	398	785	N A
1949	13 080	335 568	260 000	4 890	4 700	1 700	1 750	N A
1950	16 200	438 350	316 000	7 610	6 150	2 310	3 200	61 500
1951	16 820	592 671	365 000	6 550	5 550	2 710	2 790	64 400

* Excluding domestic operations of ASA (Sweden) and DDL (Denmark)
** Excluding domestic operations of ABA
N.A. — Not available
SOURCES: *International Civil Aviation Organization (Digest of Statistics No. 15) Scandinavian Airlines System (for 1951)*

Sweden Haunted by NATO Snub

- She has a good air force and good supporting industry, but it is after all a country with limited resources
- What worries the Swedes is this: what if NATO does not come to their aid promptly if their country is attacked?

By G. Howard Smith
(McGraw-Hill World News)

Stockholm—A spate of articles lately in English-language publications about Sweden's air force being the third largest in the world has, of course, delighted the neutral Swedes. But from here, somehow, such stories look pretty thoughtless.

Admittedly, both the Swedish air force and the Swedish aircraft industry are doing a fine job within the limits of their resources. The point is, though, that those resources are limited.

What is forgotten, too, is that one reason the Swedes have a fairly large number of planes is that they came out of the war with such an air force as they had been able to build up (as neutrals) intact. Since then they have been able to pick up some Allied surplus equipment. But the only significant addition to strength in the intervening years has been the arming of five fighter groups with British Vampires—say 300 planes.

▶ **If Russia Strikes**—In the last year, deliveries has started of the J-29 "Flying Barrels" from SAAB. So far, though, they have only gone to one fighter group. Taking into account likely deliveries over the next six months, however, what are 3,400 jet fighters worth in defending an area the size of Cuba if Russia should strike?

For the Swedish defenders, the situation is complicated by the fact that everything in Sweden is so scattered. The country is not only long (about 900 miles) but thinly populated, which means vulnerable communications. Besides supporting the ground forces, the air force will also have to give cover to Sweden's valuable little navy.

Necessarily spread thin itself, the air force would constantly be torn between choices of carrying out those two tasks or fending off an attack on a city or industrial plant or rail junction, or guarding an important strategic area.

In Sweden, all industry of use to the country's defense is in the southern half of the country, while the northern half is strategically important. (The Lapland iron mines are more vital to the NATO countries, as Sweden hardly uses any of the ore.)

For professional reasons, the Swedish air force leaders have to appear optimistic. But army men shudder at the thought of Russia being able to keep more fighter planes continuously over Swedish territory than the Swedes themselves possess. And the Russians are said to have some 2,000 jet bombers.

▶ **Too Late For NATO?**—It really boils down to this: either Sweden's air force is a suicide squad, or else the Swedes are counting on NATO if needed.

Although most Swedes pretend to think otherwise, as a nation they are obviously drawing comfort (even if it scares them, too) from what is going on just next door in Norway and Denmark. The big play the Norwegian Sola base recently got in the Swedish press is evidence enough of that.

But what if the NATO countries should consider Sweden's air force expendable? It's an unpleasant thought, but by their neutrality, the Swedes have put themselves in a position to make that possible. By remaining outside the NATO organization, they are cutting themselves off from quick aid when they would need it most—in the opening stages of a war.

The minority Swedes who oppose the Socialist-Farmer government's policy are now noting grimly that France, with American aid, will soon step into third place—quantitively—among the world's air forces. Norway and Denmark are also catching up—and more important, their defenses are intertwined with the whole NATO setup. Further, personnel is getting training in the United States and with the combined forces in Europe. The Swedes are largely cut off from all this, as well as from much technical information.

▶ **More Money, Same Size**—The Swedish air force budget for 1952 has admittedly been raised from 324 million kroner of last year to 512 millions (about $100 million). Much of the increase is, of course, just inflation. It means anyway no expansion of air power—just improvements in quality.

Essentially, what is happening in Sweden today is that SAAB is delivering the J 29s. But these deliveries are still not going to bring the last four of ten fighter groups up to full strength (75 planes). Instead, it has been decided to use J 29s to replace old Swedish twin-engined stuff in the five tactical support groups (one such group already has a Swedish jet design, similar to the Vampire).

The J-29 is a good manoeuverer, and packs a good load of rockets besides its four cannon. Indications are that the Swedes have in it a plane fully comparable to the F-86 or the MiG-15. SAAB can be justly proud of the job.

Its Swedish-built Ghost gives the J 29 about the same thrust as the F 86, but being 20% lighter it boasts a faster climb, air force spokesmen say.

But what happens when all the 600 J 29s on order have been delivered? Even if that is accomplished by 1953? What will the Russians have then? The reason for switching J 29s into tactical support is frankly stated as being the impossibility of getting any more planes anyway. SAAB is good, but it is small business by American standards (not even 3,000 workers).

Sweden's air force still lacks, practically, all weather equipment, too. All it has in that way is about 40 senile Mosquitos. If you suggest that is a weakness, though, all the answer you get is: Yes, but we have the world's worst flying climate.

Nevertheless reports indicate great improvement in instrument flying in the air force of late. Night flying does mean flying by night now—and not by the light of the moon.

Italy's Hope

- Aviation, a one-time giant, sits disorganized factories nearly idle —a huge unused reserve.
- Production of planes or parts for NATO countries seems to be the industry's only chance.

(McGraw-Hill World News)

Rome—Italy is probably the only country in the world which has an experienced aircraft industry with large unutilized reserves.

At present only six companies, seriously hampered by lack of capital, are operating at a reduced production rate, partly augmented by auxiliary production. There are five other very small manufacturers and 30 auxiliary workshops specializing in the production of aviation equipment and accessories. Eleven manufacturers have converted to other products, but have made provision for reconversion if and when possible. The sad state of the industry is seen in the recent auction sale of a bankrupt airline firm's equipment.

In 1942 there were 165,000 direct employes in airplane construction, in 1952 there are 6,000. The immediate prewar figure was around 100,000.

▶**Defense Budget**—The total defense budget for July, 1952–June, 1953 is reported to be about 787 billion lire (there are 624 lire to the dollar), of which the Ministry of Aviation expects about 140 billion. This does not appear sufficient to carry out the present plan for restoration of the industry and personnel. (Personnel would take 90% of the money.) Nothing would seem to be available for aircraft construction.

Production of planes or parts for NATO member countries is the only hope for the Italian industry.

▶**Sad State**—In the first weeks of 1952 manufacturers have had a series of meetings with Treasury and Ministry of Industry officials in an effort to gain some government backing. The Italian Government has made some attempt to assist postwar reconstruction of housing, public health, merchant marine, etc. but has done nothing for aviation in either industrial or transport fields. If government support is not forthcoming very shortly, it is not unlikely that half of the six manufacturing companies mentioned above will be forced to cease production soon. The situation has not changed since this time last year.

- **Licensees**: True, the first Vampires being built under license by Fiat and Alfa Romeo have made test flights. Three Neapolitan firms now merged

under the title Fin Messanica are discussing plans with the U S Air Force for the production of parts for the Republic F-84 Thunderjet, with which three groups of the Italian Air Force will be equipped by July, 1952. It is also reported that the London Defence Production Board favors the ordering of not less than one thousand units of a well known British jet night interceptor to be supplied by the end of 1954, as well another jet plane.

It is likely that the Italians' industry could successfully produce one hundred planes a month for NATO, if it had the orders.

• **Research.** Proper research and experimental facilities are sadly lacking. Italian technicians have had very little chance of exchanging ideas and studying developments during the past ten years. There is no windtunnel for instance, in Italy. The majority of workers have been unemployed or underemployed for many years. Many have emigrated, disillusioned by lack of prospects.

• **Lightplanes.** Private flying is at its lowest ebb since the 1920s—pre-Mussolini days. The number of privately owned planes can be counted on two hands if not one. Aero clubs are practically non-existent. The general traveling public is not air minded, and there seems no likelihood at present that it will be influenced to change its mind by powerful publicity and good service from the national airlines. Sadder still, youth sees no future in aviation, and is not interested—or encouraged to be interested.

• **Transport.** The two Italian transport companies have about 30 planes between them; the majority are Dakotas with possibly another 2 or 3 years' useful service. Another air carrier folded up during 1951. LAI had three DC-6s but an accident recently destroyed one; now there are two. Both transport companies are in bad shape financially, and need government backing.

• **Airfields.** NATO forces will not find any very satisfactory Italian airfields which could be used as bases at least during the next 12 months. The Rome (Ciampino) airfield is unsatisfactory; the international airport of Fiumicina will not be completed for at least two years; the Milan field is often put out of service by normal bad winter weather.

And the sum allotted in the budget for airport facilities will certainly not permit Italian fields to be brought into line with the needs of the Atlantic Pact.

So there sits Italian air power—a huge productive potential, but not used. Manufacturers pass the buck to the government. The government passes the buck to NATO planners. And the unemployed workers are sitting ducks for the Communist Party.

KLM Operations, 1947-1951

Year	Aircraft miles flown (000)	Passengers carried	Passenger miles (000)	Freight (tons)	Freight ton miles (000)	Mail (tons)	Mail ton miles (000)	Unduplicated route mileage
1947	15 870	342 000	295 000	4 420	4 350	1 600	625	67 040
1948	21 460	439 000	403 000	7 150	11 010	1 580	1 040	80 206
1949	19 540	394 000	494 000	6 000	9 425	1 700	1 695	111 350
1950	22 000	418 000	563 000	11 200	16 000	1 545	4 120	132 573
1951	28 425	499 000	918 000	14 140	22 340	1 885	4 410	150 000

SOURCE: KLM

Sabena Operations, 1946-1951

Societe Anonyme Belge d'Exploitation de la Navigation Aerienne

Year	Aircraft miles flown (000)	Passengers carried	Passenger miles (000)	Freight ton miles (000)	Mail ton miles (000)	Unduplicated route mileage
1946	4 45	121 136	85 240	843	397	N A
1947	7 740	186 127	133 500	3 255	587	N A
1948	6 465	140 111	134 000	5 000	720	N A
1949	6 845	188 604	148 000	4 340	878	N A
1950	10 100	198 465	165 100	8 030	1 130	33 300
1951*	11 300	250 440	191 000	12 630	1 414	33 300

* Estimated on basis of first nine months. N.A. Not available.
SOURCE: Sabena (Rapport du Conseil d'Administration et du Collège des Commissaires).

Air Power in the Low Countries

- Both Netherlands and Belgian air forces developing fast with NATO help, and Dutch industry also is an aid.
- And in addition, each country has one of the world's leading airlines—potentially valuable as airlift reserve.

(McGraw Hill World News)

Amsterdam—The Netherlands continues rebuilding the Dutch Air Force at an accelerated rate with further increase expected as NATO assistance comes through in larger quantities.

Military aviation (including Naval) is budgeted for 277 million guilders in 1952, up from 182 million in 1951. This is in a total defense budget of 1.5 billion guilders (the guilder is quoted at $0.263).

▶**Dutch Air Force**—New Meteor and Thunderjet squadrons have been added to the Air Force. Gloster Meteor Mk 8s are now being delivered regularly by Fokker Aircraft Factories in cooperation with Aviolanda Factory (of these 150 in all will be delivered to the Dutch Air Force up to the end of 1953). Some day and night fighters squadrons for territorial air defense will be augmented.

In addition the Air Force has been strengthened by some Thunderjets

(Continued on p. 230)

(McGraw Hill World News)

Brussels—Belgium must count almost all of her military aviation as part of NATO, for the port of Antwerp is of importance to Western Europe's supply strategy, her heavy industry and arms industry in the southeast are of importance to materiel, and her airbases form part of the defense pattern for the whole Western European Program.

▶**Industry**—There is very little research or manufacture in Belgium. The Fabrique Nationale d'Armes at Liege, has been manufacturing Rolls-Royce Derwent (jet) engines for a year and a half, under license from Britain. These are shipped to the Fokker plant in Holland, which makes the fuselage, and assembles the Gloster Meteor 8, under license from Britain, with a contract for 300 planes.

At Gosselis (Belgium), the Fairey factory also assembles Meteors for the use of the Belgian Air Force.

(Continued on p. 231)

Netherlands (from p. 229)

transferred from the U. S. in 1951. This transfer will be increased to some 100 aircraft in the coming few years. They are to equip the Tactical Air Force, which now has two squadrons.

The Air Force expects to continue in 1952 the rapid expansion of its Air Defense and Technical Air Force towards the planned 21 fighter squadrons. In addition Holland will have a transport unit, several artillery observation and reconnaissance squadrons. Airbases have been modernized and expanded.

Fokker is regularly delivering S-11 trainers replacing the Tiger Moth machines. More than a hundred trainee pilots have been sent to the U. S. and Canada and have returned after graduation. This training will be expanded. The Dutch Air Force has 600 trained pilots (against 200 at the end of 1950). About 30 Beechcraft trainers are also being flown.

▶**Naval Air Forces**—The Dutch Naval Air Forces consist of seven squadrons flying Fairey Mk. I, IV and V Fireflies, North American B-25s, Vickers Supermarine Sea Otter Mk. 2s, Airspeed Oxford Mk. Vs, Taylorcraft, Auster Mk. IIIs, Lockheed PV-2s, Convair Catalinas and Hawker Sea Furys Mk. XI. In addition the Navy has one aircraft carrier and one Sikorsky S-51 copter.

Fokker is building 25 Sea Furies for the Navy, under license from Hawker. NATO deliveries to the Navy thus far have included 18 Lockheed PV-2s.

▶**Industry**—A number of factories is busily engaged in the defense program.

● **Fokker Aircraft Factories** (now completely moved to its new plant near Schiphol aerodrome) is producing 330 Gloster Meteors Mk. 8 (of which the Rolls Royce Derwent engine is manufactured in Belgium). About half of the planes are destined for the Belgian Air Force. Fokker's S-11 side-by-side trainers (100 being built) are now standard trainers for the Dutch, Italian and Israeli Air Forces (in Italy large series are built in license by Aeronautica Macchi at Varese and I.M.M. at Naples). In addition Fokker is building the S-12 trainer (S-11 with nose wheel). Fokker has also developed the S-13 crew trainer of which test flights have been completed. The concern has developed the S-14, an entirely new side-by-side jet trainer for which there is great home and foreign interest, and the development of a twin-engined turboprop airliner, the F-27, is nearing completion. Total Fokker personnel is 7,400.

● **Aviolanda N.V.** of Papendrecht is building parts of the Gloster Meteors in cooperation with Fokker. Furthermore they have been entrusted with the revision of a series of Catalinas and

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Belgium (from p. 229)

▶**Air Force**—The Belgian Air Force, under the stimulus of NATO, is developing fast. Total personnel are about 14,000, of whom approximately 900 are flight personnel. Budget for 1951, including both regular expenditures and this year's share of continuing projects, is 4,427 million francs or $88.5 million. For 1952 the corresponding figure is 5,480 million francs or $109.6 million.

Present equipment includes a squadron of C-47s for transport.

▶**Meteors and Thunderjets**—Four years ago the first Meteor 4s were purchased from England, with several two-place planes for dual training. Since then a number of Meteor 8s have come from the plant in Holland, and during this year the Air Force expects to receive Meteor 11s with radar equipment for night fighting.

Last May, Gen. Lauris Norstadt brought in the first four F-84E Thunderjets, of which there are additional deliveries being made. These will make up a large proportion of the total jet plane force. Working largely toward fighter squadrons, Belgium expects to have 500 jet planes by 1954.

▶**Training**—Primary training is done in Tiger Moths and Stampe SV4s. Advanced cadet training is on Harvard Trainers and Spitfire 9s and 14s. In 1951, 267 cadets and six student navigators went to the U. S., and 15 cadets and ten student navigators to Canada for further training.

There is under construction at Kamina, in the Belgian Congo, an air base and technical school. This is designed to train the specialists needed for the Belgian Air Force, and to handle advanced flight training. It will be completed probably at the end of 1953 or early in 1954.

▶**Transport**—Commercial transport is well established in Sabena, a government-controlled company, financed partly by the government and partly with private capital. Sabena covers Europe, goes to the Near East and across the Atlantic, as well as to the Belgian Congo. Sabena has a network within the Belgian Congo.

The carrier's equipment at the start of the year included DC-6s, DC-4s, Convair 240s, DC-3s, C-47s, de Havilland Doves, an Auster V, Piper Cubs, Tiger Moths, an Avro XIX, and two Bell helicopters. Sabena plans to acquire 6 additional DC-6Bs by early 1953, for lines to New York and the Congo.

To operate this fleet they have 46 captains in Europe, 9 in Africa, 40 first officers in Europe, 2 helicopter pilots in Europe, and 1 in Africa.

▶**Airport**—As of April, 1951, there were seven commercial airports with paved runways, only three of which had one

(Continued on p. 232)

Netherlands (from p. 230)

Freighters for the Naval Air Force and 11 units for the Air Force.

• Koninklijke Nederlandsche Vliegtuigenfabriek Fokker of Amsterdam is building 75 Saab Sifir 91B trainers for the Svenska Aeroplan AB on behalf of the Swedish Air Force.

▶ Transport—KLM expects to undergo an important alteration and expansion in the near future. It had on order Jan. 31, 7 Douglas DC-6Bs, 9 Lockheed Super Constellations, 6 Convair 340s and one Douglas Liftmaster.

These were in addition to its existing 67 plane fleet of Convairs, DC-3s, DC-4s, DC-6s and Connies.

Belgium (from p. 231)

or more 4,000-ft. runways. Three other public airports were maintained in grass. There were ten military airports, of which three were grass.

However on the military side there has been a lot of building activity, and in addition to improvement of existing airports, three of the commercial bases have been taken over for military use. In a program of construction for 1954, several new important military airports are under way.

Total registered civil planes in Belgium (not including Sabena) are 210, civil pilots 728.

South Africa

• Union's air power hits postwar bottom, with little hope seen of improvement soon.

• Even the one squadron SAAF maintains in Korea is a heavy drain on its low resources

(McGraw-Hill World News)

Johannesburg—South Africa enters 1952 at the absolute nadir of its aviation resources. Its Air Force, unassisted by NATO, rated during World War II as one of the strongest, most efficient in the Commonwealth, has shrunk to a mere token force.

▶ Paper Weight—Theoretically, the SAAF has three fighter squadrons. But in fact, the single fighter squadron which it is maintaining in Korea—No. 2 Squadron—is becoming an embarrassment. Every active fighter pilot has served a tour of duty in the squadron—some of them are beginning second and third tours—and even with the addition of newly qualified pilots it has been difficult to keep the squadron up to strength despite relatively light losses—26 missing or killed so far. Within the Union there are two skeleton fighter squadrons which, in effect, are operational training units. Their equipment is 20 de Havilland Vampires (Goblin Mark Vs) and 27 Spitfire Mark 8s.

There are, on paper, three bomber squadrons. But in fact, only one squadron, equipped with Lockheed PV-1 Venturas, is up to strength. No aircraft exist for the other squadrons.

There is, in effect, one communications squadron equipped with seven DC-3s and four de Havilland Devons and a coast reconnaissance squadron equipped with 12 Short Sunderlands.

Only one SAAF service flying training school—at Nigel, East Rand—now exists and its only equipment is an unspecified number of AT-6 Harvards.

Although there are 1,194 private pilots—60% of them World War II veterans—and 358 commercial and airline pilots in the Union right now, the core of the SAAF has shrunk to a below average skeleton. In mid-1951, Active Citizen Force (Territorial or Reserve) squadrons are still flying on weekends in South Africa's major cities. Defense cuts have, however, grounded them "until further notice."

Pretoria Light Aircraft Co. planned, at the beginning of 1951, to manufacture Piper aircraft and spares under license, but no Government dollar allocation was granted for tooling up.

▶ Transports—For the five big airlines—BOAC, South African Airways, KLM, Sabena and Pan American—1951 was a year of prosperity and steady progress.

on the trans Africa route The Africa trade, in fact, offset losses incurred elsewhere and has now become established as one of the world's best paying routes Competition between the Big Five has not, as on the Atlantic route, developed into a race to provide more luxury services

South African Airways, owned and operated by the South African Government and geared up to provide the nucleus of bomber and transport squadrons for the SAAF in time of national emergency operates a fleet of four L-749A Constellations, seven DC-4s, four DC-3s and 11 Lodestars It is unlikely that the composition of its fleet will change in 1952 except, possibly with the addition of two or three DH Comets from BOAC

▶ **Bad Year**—But for civil aviation in general, 1951 in the words of O Glynn Davies, president of the South African Commercial Aviation Assn was a "pretty sorrowful" year The boom years of civil aviation that followed the war ended somewhat abruptly for more than a dozen flying schools and clubs

Private flying surely "went to the wall" in 1951 and there is little hope of recovery in 1952 Despite pleas by the Aero Club of South Africa for a $45,000 subsidy and some relief from Government taxation on aviation fuel neither of these requests has been granted by the Union Treasury At the beginning of 1952, only eight private flying clubs, which have received Government contracts to train Air Force pupil pilots still survive

At Jan 31, 1952, the Union's register of civil aircraft, private and commercial totaled 485 Exactly how many of these airplanes are unserviceable through lack of spares is problematical—probably between 35 and 40% It must be remembered that 85% of the Union's civil aircraft are of U S origin, and permits for the importation of spares—none are manufactured in South Africa—are denied to all but SAA and a few Government departments using American-built Ryan Navions

Yet another of the nation's flock of non scheduled companies folded last year—United Airways, a company backed by millionaire business man, 38 year old Joel Heroldt It went out of business soon after one of its de Havilland Doves flying between Margate (Natal) and Johannesburg, disintegrated in turbulent weather, killing 12 passengers and crew

Sole survivors of the nation's pre war rash of private companies, are Commercial Air Services (two DH Doves, two Cessna 195s, two Cessna 170s, six Cessna 140s), Tropic Airways (three DC-3s, one Avro York) and Pan African Airways (three DC-3s and two Avro Tudors under charter from William Dempster, London)

Indian Aviation

- Air force is not strong enough to hold off a powerful invader for very long
- But very little is being done to strengthen either military or civil aviation

(McGraw-Hill World News)

Bombay—Both branches of Indian aviation—civil and military—face 1952 in a mood of frustration.

The civil airlines are struggling to survive under a government which seems determined to squeeze them out of business, while the Indian Air Force barely squeezes out of India's defense budget enough planes and men to maintain its strength of ten squadrons.

▶ **Air Force**—The Indian Air Force is now completely home grown, except for its commander, who is British, and its planes, which are British and American. Its pride is its one fighter squadron (12 aircraft) of de Havilland Vampires and three squadrons (36 aircraft) of Hawker Tempests. It has about 50 B-24s, enough to form two to three Bomber Training Units. Three or four squadrons of transport aircraft (about 40 C-47s) complete the tally. With less than 300 pilots and about 3,500 ground personnel, the Air Force stands at about two thirds of its paper strength, and there is no sign of a build up.

India's present air strength is maintained with a wary eye on Pakistan, not for general defense of the country, for which it is entirely inadequate. The dispersal allowed by the country's 150 airfields and vast territory might enable this tiny force to survive briefly against a powerful invader, but not for long, in the opinion of competent observers.

▶ **Civil Picture Dark**—There are now eight air transport companies left in India out of the 22 which launched themselves hopefully in 1946 and 1947. Not all the survivors expect to survive much longer. With operating costs among the highest in the world ($120 per flying hour) and fares among the lowest (controlled by the government at an average of less than 4 cents per passenger mile), these companies don't see how they will be able to make a profit.

The heaviest cost item is fuel. New Delhi levies a tax of about 20 cents on every gallon of aviation fuel sold.

Last year an Air Transport Enquiry Committee recommended that the government subsidize the airlines, but, apart from a partial rebate on the fuel surcharge, the Directorate of Civil Avia-

tion has not proved very cooperative.

New Delhi has already established an aircraft building industry on a national basis. The government-owned Hindustan Aircraft Factory at Bangalore, although at present only an assembly and overhaul plant, hopes to produce a transport plane of its own design in eight years (it built its first plane, a de Havilland H2 trainer during 1951).

Meanwhile the 100 Douglas Dakotas (DC 3s) used by civil airlines, most with less than 10,000 flying hours, are reckoned good for another ten years.

Norwegian Air

- Norway slowly beefs up its air force with help it is getting under MDAP schedules.
- Mutual training agreement with Denmark will provide the two with pilots and technicians.

(McGraw-Hill World News)

Oslo—After World War I, Norwegian military air power was rather small, but since joining NATO, the picture has changed considerably.

Norwegian air power now includes two Vampire squadrons, one transport squadron, one reconnaissance squadron, two Spitfire squadrons, and six Thunderjet squadrons. The F-84s are not all here yet, but are coming in gradually.

Military plane production is non-existent, and there is little likelihood of any in the near future. The few pre-war factories are now only maintenance depots. Research is on a small scale.

▶ **Defense Budget**—The military budget has risen from 63.6 million kroner in 1951-52 to 114 million kroner for 1952-53, with a supplementary 86.5 million kroner for the next two and one-half years (there are approximately seven kroner to the dollar). These figures exclude aid under MDAP.

Denmark and Norway have entered an agreement for mutual training of pilots. Norway will provide basic training and radar training. Denmark will offer advanced training and gunnery.

▶ **Civil Aviation**—The amalgamation of the three Scandinavian national airlines, begun in 1946 with the overseas services was completed last year with the integration of domestic routes. SAS Scandinavian Airline System includes DNL, Det Danske Luftfartselskab; DDL, Det Danske Luftfartselskab, and ABA, Swedish A B Aerotransport.

There is no civil production of planes in Norway today, although one factory has plans to start. Thirteen carriers are registered, of which SAS is largest.

Spain's Plight

• If you're talking manpower and airways, the Spanish air force is full strength, up-to-date.

• But if you're talking planes, you have a prewar hodge-podge of some 200 obsolete aircraft.

(McGraw Hill World News)

Madrid—Spanish aviation is blocked at every turn by the almost non-existence of modern technical equipment and trained personnel. But in spite of its handicaps, Spanish aviation has made slow but steady progress since 1946.

Air Force manpower has been kept at full strength, though military air activity is practically nil; new air bases are being built and old ones improved and, with a sense of responsibility toward modern commercial aviation, aeronautical authorities (bucking their greatest obstacle) have maintained enough modern airways electronic facilities to meet international civil air requirements.

▶ **Military Aviation**—The Spanish Air Force absorbs 7% of Spain's annual budget. It includes 4,000 officers, of whom 1,400 are pilots, and 35,000 enlisted men.

The fleet consists of some 200 planes: 60 transports, 86 bombers and 56 fighters—all pre-World War II models. The transports are Junkers 52s, the bombers a hodge-podge of Savoia 79s, Junkers 88s, Heinkel 111s, Dorniers and Lockheeds. The fighters are Messerschmitt 109s and Fiat 32s.

In addition the Air Force has a few recently purchased two-seater training planes and 150 fuselages of Messerschmitts bought during the war, which for some time have been awaiting motors. Many of these planes are in poor flying condition, and according to military experts one half hour of modern aerial warfare would do away with the entire Spanish Air Force.

But even though the fighting power of the Spanish Air Force is practically nil a big effort has been recently made to enact a large program of construction of new airports and enlargement of those now existing. At present there are nine major fields throughout Spain with paved runways, three of which (at Madrid, Barcelona and Seville) are some 10,000 feet, with asphalt tops capable of resisting jet gases. In addition there are 19 major military air bases and some 70 emergency strips built during the Civil War.

The 1,500 registered pilots (including Air Force and reserve) are well trained. Spanish pilots earned utmost respect from foreign observers during the Spanish Civil War, and according to the opinion of military experts here could quickly take to modern techniques and equipment.

▶ **Industry of Research**—Industrial production for aviation can almost be discounted. There are only seven aviation manufacturing plants in Spain. Of these, only one, Construcciones Aeronauticas, S.A., is actually set up to make planes but its rate of production is extremely low. The others turn out motors, fuselages, armament and propellers—also at a very low rate of production.

Spain has one aeronautical research center—at Torrejon (Madrid), called "Aeronautical Technical Institute"—but it is still in the making. Although the buildings are up and runways graded, they still lack the technical installations.

▶ **Transport**—Spain has two commercial air companies, Iberia and Aviacion y Comercio. The more important, Iberia, financed by the Government through INI (Instituto Nacional de Industria), operates domestic and international flights connecting Spain with Italy, France, Spanish colonies and Central America. Fifty pilots operate the line. Iberia's fleet is composed of six DC-4s, ten DC-3s and three Junkers 52s.

Aviacion y Comercio, currently operated by 18 pilots, was a freight company recently authorized to carry passenger traffic. It has a fleet of six Bristol 170s. Both companies had no accidents in 1951.

▶ **Airways**—After World War II, Spain took over the two "console" beacons in Lugo and Seville, which had been installed and used by the Germans during the war. Today these are two of the five main radio navigational beacons along Europe's western coastline used by trans-Atlantic flights.

In 1947, TWA offered the Government $20,000 worth of radio aircraft communications equipment if it would operate and maintain it for the benefit of all airlines. Spain accepted. Now she has a fair ground installation able to cope with her growing international air traffic.

▶ **Assets**—On the whole, manpower and ground installations, (the latter could easily and quickly be enlarged because of hard flat terrain all over Spain and dry weather in the central and southern tablelands), are the major contributions that Spain could give today to the Western nations' air power.

Although training and a large amount of equipment will be necessary to make out of the Spanish Air Force a modern fighting factor, the actual assets are by no means negligible, especially because of the country's geographical situation which puts her bases out of reach from mass air attack from the east, and yet within the limits of the West's bombers.

Brazilian Air

• Far from any potential zone of combat, Brazil's air force is secondary training school.

• But her commercial aviation is active, increasing its fleet to 336 planes in 1951.

(McGraw Hill World News)

Rio de Janeiro—Brazil continues to be a negligible factor in the world air power picture, and is sure to remain so for at least another year. Its entire aviation budget for 1952, civil as well as military, amounts to only $97.9 million.

▶ **Minor Power**—The military aviation picture has not changed appreciably since a year ago, nor is any expansion in sight. Brazil still has no jet planes of any description, nor does its air force hold title to any four engined aircraft.

Six B-17 search and rescue aircraft have been loaned by USAF for training in operation and maintenance of 4-engine planes and for familiarization with mapping and rescue work. "Combat" aircraft, granting use of the word to extremely obsolete types, consists only of a couple of squadrons each of P 47s, B 25s and A 20s.

Far from any potential area of combat, Brazil continues to operate its air force mainly as a secondary training school, readying air and ground personnel for transition into modern warplanes when and if either the necessity or the finance should appear. Pending such developments, both of which appear rather remote for the time being, it maintains very close relations with USAF through the Air Force Section of the Joint Brazilian U. S. Military Commission which acts as technical consultant.

▶ **Civil Fleet**—On the civil aviation side Brazil is much more active. Its commercial air fleet totaled 336 planes at the close of 1951 compared with 293 at close of 1950. Licensed commercial pilots totaled 1,663.

Sao Paulo's civil airport of Congonhas qualified easily as one of the world's major air terminals. It handled 78,401 flights and 1,025,786 passengers. Second Brazilian terminal was Rio's Santos Dumont with 60,342 flights and 907,306 passengers. Congonhas should top its record by a wide margin during the coming year which is to see completion of both runway length expansion and GCA landing equipment installation.

The coming year also should see a start on expansion at Santos Dumont. The present runway (only one is needed because of prevailing winds) is only 1,000 meters long and operators are using a 500 meter extension is needed

Mexico

● Government is concentrating on public works; depends on U. S. for air cover, if needed.

● So air force struggles along with small, obsolete fleet and limited training program.

Mexico City—Although Mexico's airlines bought a number of new commercial planes during the past year, the Mexican Air Force changed only in that its already antiquated planes got older and were in a good part retired.

It is estimated that the country's 49 commercial airlines, including foreign carriers operating in Mexico, carried 1,100,000 passengers during the year. This is a gain of about 9% over 1950.

The total passenger kilometers is estimated at close to 700 million, slightly more than the previous year. This reflects a decrease in some routes flown, but compensated by heavier loads on those flown.

▶ **Equipment**—Major changes in equipment during the past year were the purchase of 14 Convair 340s—11 of them by Compania Mexicana de Aviacion (Mexico's largest domestic line, a PanAm affiliate) and three by Aeronaves de Mexico, the line which flies the heavily traveled (over 150,000 passengers a year) Acapulco resort flight.

Mexico had 487 commercial planes flying over regularly scheduled routes or on charter use, plus 940 private planes.

▶ **Air Force**—The Mexican Air Force was given a budget of roughly $2million, which observers said was just about enough to meet the payroll and maintain the existing training schools. There was some talk of buying used transports from the U. S., but nothing definite was announced on this score.

The military finished the first runway on their new Santa Lucia military air base in the state of Hidalgo, some 30 miles north of Mexico City on the Pachuca highway. The runways will be long enough to handle the biggest planes made today, it is said. However, only the first runway is finished so far.

At ceremonies at the opening of the field, one Mexican newspaper reported jet planes "belonging to the Mexican Air Force" were flown, but it is believed this was not true as the Mexican Air Force includes no jet planes as far as is known. A French jet, then being demonstrated by the French government, may have given rise to this report.

A mass paratroop jump by one battalion was staged during the year and rated as being professionally carried out.

Every aircraft in the Mexican Air Force is obsolete at the moment, and the government obviously has no intentions of diverting funds from other projects to the Air Force at this time.

It is presumably the policy of the Aleman government, which goes out of office in July but will undoubtedly be succeeded by one of Aleman's cabinet officers who will carry on with the same program, to put all available federal funds into projects to increase the economic strength of the country (such as new railroads, dams, irrigation, power, schools, roads) and let the U. S. be his air cover in case of an emergency.

▶ **Equipment**—At present the Air Force consists of some 200 planes (many have been junked out of 250 reported last year) consisting of about 150 AT-6s, about 20 F-47s, and an assortment of C-47s, AT-11s, BT-13s, BT-15s and PT-19s. All are obsolete types, and all are in poor shape except the transports.

Four training schools turn out some 25 pilots a year plus ground crews. The Mexican youths make good pilots but only get four hours a month flying time.

Mexico did have a good squadron (201st) active in the Pacific during the last war, but to repeat this modest project at this time would probably take close to two years to get new planes and train pilots.

Of a total defense budget of 328 million pesos (less than that alloted for education or for irrigation) the Air Force gets 17 million or about $2 million for this year.

Chile's Airline Shows Steady Growth

To a nation cut off from most of its neighbors by mountain barriers, as Chile is, aviation provides the one quick, sure avenue of communications.

Linea Aerea Nacional, Chile's state owned airline, has provided this avenue, and enlarged it steadily through the years. In 1950, LAN carried over 81,000 passengers—including more than 13,000 international—compared with 66,000 the year before, and 2,600 in 1940.

On the Santiago-Buenos Aires run, LAN's Martin 2-0-2s, competing with three other lines, carried 30% of the traffic in 1950.

The carrier's present fleet includes four Martins, four Lockheed Lodestars, four Lockheed Electras, six Douglas DC-3s, 12 de Havilland Doves and one Beechcraft Bonanza trainer. Overhaul work is done at the line's workshop at the Los Cerillos airport, Santiago.

Despite LAN's hazardous routes and the lack of emergency landing areas, the carrier has seven times won the Inter-American Safety Award for accident-free flying—for 1942, 1944-'46, and 1948-'50.

ORGANIZATIONS

(Organizations play a special role in air power by providing a meeting ground for mutual attack on mutual problems. The membership of some of the more important U. S. aviation groups is listed in this section.)

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Thompson Products, Inc., 23555 Euclid Ave., Cleveland 17, Ohio.

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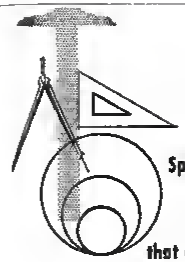

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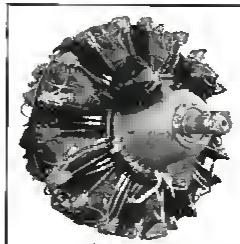

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98	1685HAR	Holley carburetor
18	1375F	Holley carburetor
407	SF6LN 2 (Connecticut Aircraft part No. 10-18453-6 Spec. AN6511)	Bendix Scintilla Magneto
42	SF5RN 18 (Connecticut Aircraft part No. 10-26170-1)	Bendix Scintilla Magneto
185,000	L54AD3	Spark Plug (Aero)
30,000	LS 6S8A	Bendix Scintilla Spark Plug

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936	PR48 A1	Stromberg carburetor
26	PR48 A2	Stromberg carburetor
31	PR48 A3	Stromberg carburetor

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560	3506	Flange
130	4288	Follower Assy.
814	3514	Blower Assy.
53	4836E	Shaft
175	4836J	Shaft
56	4872B	Sleeve
390	4846I	Gear
78	7623G	Gear
1178	84280	Bearing
113	84467	Housing
73	84591C	Nose Housing
200	4835O-D	Crankcase Assy.
200	84083	Cylinder
100	84084	Cylinder
200	84085	Cylinder

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38	10567 2	Airesearch	Aluminum Oil Cooler
120	MF9-713 15A	Vickers	Hydraulic Pump
160	1375E	Pesco	Fuel Pump
700	TFD 6500	Thompson	Fuel Booster Pump
185	D7618	Adel	Anti-Ice Pump
50	9P72L-A	Pesco	Fuel Booster Pump
250	AN4014	Elin Minier	Wobble (D-3) Pump
300	11-1260-K & KA	Pesco	Hydraulic Pump
10	AN5531 1	G. E.	Inst. Generator
1000	AN5780 2	G. E.	Wheel & Flap Position Indicator
400	AN5700 2	Weston	Wheel & Flap Position Indicator
16	26B10	Lewis Eng.	Cyl. Head Temp. Gauge
10	46E2	Lewis Eng.	Air Temp. Ind.
31	47B21	Lewis Eng.	Temperature Ind.
12	47B2E	Lewis Eng.	Temperature Ind.
98	47B53	Lewis Eng.	Temperature Ind.
36	47B54	Lewis Eng.	Temperature Ind.
10	76Z9	Lewis Eng.	Air Temp. Ind.
11	7684	Lewis Eng.	Temperature Ind.
20	77C4	Lewis Eng.	Temperature Ind.
21	77C5	Lewis Eng.	Temperature Ind.
85	727TY72Z8	Weston	Left Wing Anti-Icing
88	727TY73Z8	Weston	Right Wing Anti-Icing
83	727TY74Z8	Weston	Ta-I Anti-Icing
11	3227 11D 3A	Edison	Dual Tachometer
44	59A85DJ4E	G. E.	DC Motor (½ HP)
83	A4634	Delco	Motor
50	RD8220	Holtzer-Cabot	DC Motor
49	FD65-5	Diehl	Motor
47	FD65-6	Diehl	Motor
116	A371805	Dumore	Motor
780	A371206	Dumore	Motor
115	F4CA2A	Parker	Primer
70	AN3612 1	Scintilla	Ignition Switch
450	A 9 (84 38226)	Nason	Ignition Switch
687	RS-2	Mallory	Selector Box
90	JH630 R	Jack & Heintz	Starter Motor
498	S 841 (84 38253)	Electronic Labs	Box
53	AN4203 3	Rendla	Accumulator 10" 1500 P.S.I.
1000	1301 B A	Rendla	Interphone Box
140	R1464AE	Marquette	Windshield Wiper Kit
100	EXLC 2334	Bendix Colman	Control
11	18086-1C	Edison	Amplifier
174	450-0	Skinner	Gasoline Filter
250	556-1A	Eclipse	Oil Separator
100	716 3A	Echlin	Gasoline (NEA 3A)
37	117 47	Edison	Detector
88	358	Edwards	Horn
50	764 F	Stewart Warner	Heater
980	921 B	Stewart Warner	Heater (200000 BTU)
340	981280	Kidde	Co2 Cylinder
85	15924 3	Adel	Link Valves
90	933748	Kidde	Oxygen Cylinder
80	DW88	Eclipse	Transformer
87	604H 146A	Cutler-Hammer	Relay (R-12)
98	0635-D	Ace	Oxygen Regulator
148	FG208AS1	Minn. Honeywell	Air Temp. Switch
33	DW47	Echlin	Transformer
11	DW33	Eclipse	Transformer
65	ASDC2	CO2 Mfg. Co.	Fire Detector
750	ND21	American Gas Accumulator Co.	Temp. Delay Relay
38	U6005 DV5	United Air Prod.	Oil Temp. Reg. 5
29	UA 3160	United Air Prod.	Oil Temp. Reg. 6
95	UA 3160C	United Air Prod.	Oil Temp. Reg. 6"
73	UA 5007 CF DV5	United Air Prod.	Oil Temp. Reg. 7
14	UA6008 5-30	United Air Prod.	Oil Temp. Reg. 8"
11	UA 6010K—530K	United Air Prod.	Oil Temp. Reg. 18

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Airlines Re-shuffle N. Y. Flights

Idlewild gets most traffic from closed Newark field after residents near LaGuardia protest 'hazards.'

The fast-breaking airline and airport safety and anti-noise campaign took several sudden turns last week in the wake of three fatal airplane crashes into Elizabeth, N. J., which brought about indefinite closing of Newark Airport.

- **Airlines cut LaGuardia schedules** back below last year's average, despite the recent upsurge of demand because of the closing of Newark Airport. The move by the specially formed National Air Transport Coordinating Committee is aimed to mollify dwellers in the traffic area around LaGuardia. Residents of Queens had called the heavy traffic a hazard and threatened action that might have led to worse restrictions.
- **Preferential runway selection** was permitted by CAA. CAA has heretofore been inflexibly strict in requiring use of the mathematically determined "favored" runway, even under light wind conditions. The new relaxation of CAA runway regulations will allow an airliner to pass up the favored runway and pick one less likely to bother residents. But the pilot remains the final judge on whether or not to use the less favored runway.
- **CAA ordered re-wiring** of propeller reversing mechanisms on airliners having the Hamilton Standard propeller on Pratt & Whitney R-2800 engines. Investigators had found that the National Air Lines DC-6 that crashed in Elizabeth had its No. 3 prop reversed and No. 4 feathered.
- **Airlines re-scheduled** N. Y. flights through negotiations in their National Air Transport Coordinating Committee, chairmanned by EAL President E. V. Rickenbacker. A number of flights are canceled. Most former Newark flights, including Slick and Flying Tigers cargo, moved to New York International Airport at Idlewild.
- **CAA moved more landing aids** to Teterboro Airport, which is earmarked for diversion of Newark traffic of non-scheduled airlines and non-airline users. CAA installed an "H" facility—non-directional beacon—and planned to move the mobile GCA radar unit from Newark.
- **Senate Commerce Committee** Chairman Edwin Johnson said on the Senate floor that "our committee will strongly recommend that if (Newark) airport is reopened, any dangerous runways, such as Runway No. 6-24, shall not be opened to traffic at Newark Airport."

Ocean Coach Okayed

CAB has approved the trans-Atlantic air coach fares set by International Air Transport Assn. to start May 1.

This calls for a round-trip fare New York-London at $486 in travel season and $417 off-season, compared with standard fare of $711. Fares between other points are reduced in a similar manner.

The Board expresses "complete satisfaction" with these fare agreements of the international carriers made at Nice, France, last November.

TWA reports its trans-Atlantic coach flights are already "virtually all booked from 78 to 100% full through July." TWA forecasts that a half-million people will cross the Atlantic by air this year, compared with a third of a million last year.

Air Safety Board

Appointment of a three-member Presidential Emergency Air Safety Board to survey air safety at major airports throughout the country was announced last week.

Lt. Gen. James Doolittle is chairman of the group. Other members are Dr. Jerome C. Hunsaker, chairman of NACA, and Charles F. Horne, CAA Administrator.

Jet Pioneer Dead

One of America's pioneer jet engineers, Donald F. "Truly" Warner, 53, died Feb. 12 at his home in Marblehead, Mass.

Warner had been an engineer with General Electric at Lynn, Mass., all his professional career and directed development of the first jet engine built in the U. S. Design engineer for GE's Aircraft Gas Turbine division since 1947, he was greatly responsible for development of the axial flow J47 turbojet.

RAF to Get 500 Sabres Next Year

(McGraw-Hill World News)

London—First of 500 Sabres for the Royal Air Force is expected to be delivered here by Canadair Ltd., Montreal, early next year. The Sabres are being purchased by RAF from last year's arms aid.

Canadair is building the airframes, U. S. is supplying the engines.

While Royal Canadian Air Force already has Sabre squadrons on duty with the North Atlantic Treaty Organization, the RAF will be the first European air force to have an F-86 outfit.

▶ **Shelved Design**—The British aircraft industry is resigned to the need for Sabres. But one company says it had a comparable design ready for production three years ago, at the height of Britain's defense austerity, but shelved it for more advanced development when no orders were forthcoming.

RAF will use the Sabres as an interim for the Swift and P.1067, which they hope to have in service by 1954. The Sabres will be used for daylight interception alongside the Meteor 8. The Venom 2—radar-equipped two-seater—will be used as a night interceptor. The Venom 1 (single seat) could be used as a daylight interceptor, but now is designated the FB 1 fighter-bomber by the RAF.

There is no indication purchase of Sabres will have any effect on British production plans.

Civil Training to End

Air Force will conclude all contracts for technical training of enlisted personnel in civilian schools by next September, a spokesman said last week.

The civilian contracts are not being canceled, the Air Force said, but will be concluded by gradual expiration of short-term contracts.

Specialists Sought

Air Force is offering direct commissions and active duty to 700 qualified technical specialists, primarily in the fields of communications, psychological warfare, procurement, weather and auditing. Other specialties include mechanical, civil and industrial engineers, meteorologists, electronics specialists, psychological assistants, controllers, intelligence specialists, cryptoanalysts, map reproduction engineers, air police and laundry engineers.

F3D-3 Out

- **Navy cancels proposed heavy Skyknight fighter.**
- **But the present version is retained for other jobs.**

Douglas Aircraft Co has been notified by the Navy Department that its planned procurement of the F3D-3 twin-jet all-weather carrier-based fighter is canceled. The plane would have been a heavier, more powerful version of the present F3D-2 Skyknight.

Navy says, however, that the F3D-3 program cancellation will not affect present procurement of the F3D-2 Skyknight.

Navy decision to cancel the two-place all-weather fighter program was predicated upon two factors:

- A preference for single-seat all-weather fighters.
- Navy has not been wholly satisfied with combat speed and performance of the F3D-2 in its present mission.

Presumably the present F3D-2 Skyknight will be given a new mission more compatible with its performance. Unofficial Navy sources indicated that the Skyknight would probably be assigned to interdiction category rather than fighter.

The F3D-2 is powered by two Westinghouse J46 axial-flow turbojet engines developing 4,000 lb. thrust each and mounted on the lower sides of the forward fuselage. Normal armament consists of two 20-mm. cannon mounted in the lower section of the nose below the plane's radomar equipment. There is also provision under the wings for bombs, rockets, etc.

Carrying a crew of two, the F3D-2 has a span of 50 ft., a length of 45 ft. and a height of 16 ft. The crew sit side by side in a pressurized cockpit.

The plane has a 1,500-mi. range and a service ceiling of 45,000 ft. Gross weight is 27,000 lb.

New Interceptor System for Navy

Navy expects to have a completely automatic airborne interceptor armament system flying "within the near future," according to a BuAer spokesman. Navy is believed to have at least three major avionics manufacturers working on such systems.

Air Force announced some time ago that its own interceptor armament package was being developed by Hughes Aircraft Co., but until now Navy has been silent on its own activities in this field.

$1.4 Million Asked To Test Jet Types

A $1.4-million appropriation to launch a Civil Aeronautics Administration program for testing jet aircraft over the airways, looking to the development of a transport type, was requested last week by President Truman.

The program contemplates test runs of an Avro Jetliner, two models of the North American B-45, and two models of the Douglas F-3D.

The President's request stated:

"The airlines and the aircraft manufacturing industry are now prepared to finance jointly the development of one or more jet transports. While no government funds will be required for the actual development phase, considerable design and operating data on jet aircraft are needed for development purposes as well as for regulation of air safety and control of air traffic by responsible federal agencies. Under this proposed appropriation, several different types of available jet aircraft will be extensively operated in order to collect the needed information."

Interchange Opens New Route to West

CAB has granted a new transcontinental route from Miami to the West Coast by equipment interchange of three airlines—Eastern, Braniff and TWA.

This new order in the southern-service-to-the-west case replaces an interchange that CAB proposed in its original decision on the case. CAB says its change was "motivated by the fact that no operations had been inaugurated under the Braniff-Continental-American interchange and by the belief that the service was unsound both as a matter of operations and of economics."

The new order breaks what would have been an American Airlines monopoly on the western portion of southern transcontinental service.

The new interchange route is Eastern from Miami to Houston, Braniff to Amarillo and TWA to the West Coast. The other two southern transcontinental interchanges now operating are Delta-American and National-Delta-American.

ACC Pushes Copters

The Air Coordinating Committee, in a report forwarded to Congress last week by President Truman, declared that the government should encourage development of helicopters for commercial use and predicted heavy utilization of copters in inter-city flight service.

The report recommended that commercial operators be given every opportunity to establish helicopter connecting services and that they be permitted some helicopters now despite present military demands.

MDAP Air Aid Passes $1 Billion

U. S. aircraft shipments to European nations since the flow started under the Mutual Defense Assistance Program have passed the $1-billion mark, according to the President's report to Congress.

Shipments by periods:

- **October, 1949, through March, 1950:** $28 million.
- **April through September, 1950:** $223 million.
- **October through March, 1951:** $474 million.
- **April through September, 1951:** $376 million.
- **Total for the two-year period:** $1,101 million.

For the current (1952) fiscal year, U. S. Air Force is sponsoring a $59 million training program in MDAP countries, according to the report. $53 million in European countries, $3 million in Greece, Turkey and Iran, and $3 million in the Far East.

USAF's foreign training program totaled $41 million last fiscal year and only $10 million in the 1950 fiscal year.

Aircraft Landings To Be Discussed

Discussions of all factors affecting approach and landing of aircraft and an exchange of views on future airborne radio equipment will highlight the International Air Transport Assn. technical conference at Copenhagen, May 5-16.

Over 200 technical experts representing airlines, manufacturers, governments, research laboratories and other agencies are expected to participate in the conference, which also will have a full agenda of engineering operations, meteorology and communications matters.

British Viking Hits Mountain, 34 Killed

An Africa-bound twin-engine British Viking airliner, on a charter flight from London to Nairobi, crashed into Mount Rose peak in the Sinjhan Mountains, Feb. 16, killing all 34 passengers aboard.

The plane was chartered by Hunting-Jan Air Transport Co., and carried some personnel assigned to a new air field at Entebbe, Uganda.

Take a look at the CONVAIR B-36...

RB-36D version of famed intercontinental bomber

...and see what makes it potent

THE Convair B-36 has speed, manueverability, firepower, accuracy, eyes that see in the dark, and power to get to extreme altitudes. Here's how it gets these qualities.

A special General Electric turbosupercharger system soups up the piston engines to give normal rated horsepower up to extreme altitudes. Four G-E J47 jets supply more than 20,000 pounds of additional thrust.

A G-E remote control armament system locates the gunner in a pressurized compartment away from his guns. G-E fire control radar tracks attacking fighters to supply aiming information. G-E electric computers make the defensive counterpunching faster and more accurate.

Ignition transformers on the engines, tiny fractional horsepower motors in the propellers, governors on the power system, position indicators, voltmeters, ammeters—all do their part in keeping the big bomber strong.

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